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Mrs. Hall

6/6/87

TRANSACTIONS

OF THE

EPIDEMIOLOGICAL SOCIETY

OF

LONDON.

NEW SERIES. VOL. V.

SESSION 1885-86.

LONDON:
SHAW AND SONS, FETTER LANE, E.C.

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CONTENTS.

Notes on Some Recent Epidemics at Home and Abroad. Inaugural Address of Session 1885-86. By WALTER DICKSON, M.D., R.N., President - - - - - - - 1

The German Vaccination Commission. By E. J. EDWARDES, M.D. Lond., M.R.C.P.Lond. - - - - - 27

Diphtheria as a Chronic Malady in Particular Individuals, with Liability in them to Recrudescence. By D. ASTLEY GRESSWELL, B.A., B.M.,Oxon. - - - - - 57

On Asiatic Cholera in our Fleets and Ships. By Sir WILLIAM SMART, M.D., K.C.B., K.I.H. - - - - 65

Observations on a Certain Malady occurring among Cows at a time when the Milk produced by them disseminated Scarlet-Fever. By JAMES CAMERON, M.D. - - - - 104

On Certain Supposed Injuries by Vaccination in North Germany in 1885. By GEORGE BUCHANAN, M.D., F.R.S. - - 114

Hydrophobia Statistics. By G. B. LONGSTAFF, M.B. - - 119

On the Results of the International Sanitary Conference of Rome, 1885. By R. THORNE THORNE, M.B.Lond., F.R.C.P. 135

Report of the Vaccination Committee - - - - 150

Gavin Milroy, M.D. - - - - - - 169

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C. 1851. Noble, Daniel, M.D., 258, Oxford Road, Manchester.
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N.R. 1881. Russell, E. G., M.B., B.Sc., Surg. Ind. Med. Dept., Gauhàti, Assam, India.
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C. 1855. Tribuchet, Adolphe, Paris.
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N.R. 1880. Whishaw, J. C., M.D., Surg.-Major Ind. Med. Dept., Lucknow.
N.R. 1880. White, J. Berry, M.D., Surg.-Major Ind. Med. Dept., St. Andrew's House, Hertford, Herts (*retired*).
C. 1861. Whitelaw, Wm., M.D., Kirkintilloch, Dumbartonshire.
N.R. 1854. Wiblin, John, Southampton.
N.R. 1865. Williams, C., 48, Prince of Wales's Road, Norwich.
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N.R. 1872. Woodall, John (address not known).
N.R. 1875. Wortabet, John, M.D., St. John's Hospital, Beyrout.

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INAUGURAL ADDRESS OF SESSION 1885–86.

WITH NOTES ON SOME RECENT EPIDEMICS AT HOME AND ABROAD.

By WALTER DICKSON, M.D., R.N., President.

(*November 11th*, 1885.)

Gentlemen,—I thank you most heartily for having raised me to the presidency of this Society, and I must ever consider it as a high honour to have been deemed worthy, through your kindness, to succeed the eminent men who have occupied this chair and contributed so much to promote and diffuse epidemiological science. I value the compliment the more highly as conferred by a body of gentlemen comprising so many distinguished veterans in sanitary work, who have combated disease and death, some in distant lands and some at home, and who have since availed themselves of the opportunity of learned leisure, and dignified but not inactive retirement, to contribute to this Society, and so to the profession and the public, the matured results of much thoughtful observation and world-wide experience.

During the twenty-three years I have enjoyed the privileges of Associate and office-bearer many changes have occurred in the composition of our Society, and also, to some extent, in its functions and scope of action. In 1862 the science of public medicine had only just begun to show a bold front in our civic polity under the banners of two illustrious leaders, and the names of Simon and Farr must be held in lasting and grateful remembrance. Mr. Simon, as well as Drs. Milroy and Richardson, Mr. Chadwick, and Sir William Jenner, who all at that time took an active share in our discussions, are happily still among us, but many of our whilom colleagues have passed away. The memory reverts to our first President, Dr. Benjamin Babington, a most genial as well as ingenious man, of extensive knowledge and fertility of resource, of a wide and varied life-experience, for

he had in his youth served as a midshipman in the Royal Navy, and was for some years in the Civil Service of India. Dr. Seaton was also long an ornament of this Society. His amiable disposition and courteous, winning manners endeared him to all, while his industry and perseverance and unwearied efforts in the cause of vaccination have borne good fruit in the mild character and diminished mortality of the recent epidemics of small-pox by which we have been visited.

Our opening anniversary last year was clouded by the recent death of Mr. Netten Radcliffe, whose diligence and zeal in epidemiological research could not be surpassed. For many years he was a most active member of the Society, discharging with great energy and ability the onerous duty of Secretary, and subsequently held for two years the office of President. The labour he bestowed, and the warm interest he took in our proceedings, conduced, doubtless, very much to our growth and prosperity.

Of other eminent colleagues now gone to their rest were Drs. Copland, Stewart, Murchison, Parkes, Goodeve, and Sir Ranald Martin; and in that branch of the public service with which I have the honour to be connected, Dr. Bryson, some time Medical Director-General of the Navy, and Dr. Eugene Mackay, Medical Statistician at the Admiralty, both of whom, during their tenure of office, greatly improved the reports on the health of the Navy, and frequently took part in our discussions in this place on the subjects with which they were conversant.

I regret to add to the list of departed naval worthies the name of Dr. Thomas Colan, Inspector-General, who died recently at the early age of fifty-four. Although not a member, he occasionally took part in our discussions. An officer of varied and distinguished service, he became widely known a few years ago from having been in medical charge of the last Arctic expedition, and his views as to the formidable outbreak of scurvy and its possible prevention, were supported and confirmed by a most intelligent and painstaking committee appointed by the Admiralty to adjudicate on the matter. In Dr. Manson Fraser the Society has lately lost, by a tragic death, a member of great promise and of proved ability, both as student and practitioner. A distinguished graduate of Aberdeen University, he had been engaged in hospital practice at Liverpool and at Homerton Fever Asylum, and had written papers on scarlatina and fever. In 1883 he went out to Borneo to fill the appointment of medical officer. He was attacked on the Kawning

River by a party of fanatical natives, who slew him and three Sikh policemen who accompanied him, adding one more name to the long roll of medical martyrs for the great cause of science and humanity.

One of our Vice-Presidents, who occupied a prominent position, has passed away during the year. Sir William Muir, after long and distinguished foreign service, presided for some years over the Medical Department of the Army, and proved himself to possess high administrative qualities in that eminent but difficult and responsible office, together with an amiability of character which charmed all who knew him.

Only a few weeks ago we had to lament, in common with the whole country, and I might justly say, the whole world, the loss, in the fulness of age, of a great and good man, who for many years had been one of our honorary Vice-Presidents. Lord Shaftesbury was the perfect type and pattern of the Christian philanthropist. His name will be long held in veneration, while his noble example will encourage others of his rank to follow in his footsteps, "and, whilst they have time, to do good unto all men"; and will rebuke the rich and luxurious, the idle and selfish, who, with all the advantages of wealth and station, are unprofitable servants, and pass into oblivion unregretted and unlamented. As a leader in sanitary reform, and as Chairman of the Lunacy Board, Lord Shaftesbury knew more of medical men than any other statesman; and by no class of his fellow-citizens is this illustrious man more deeply mourned than by those who, often with scant reward, toil like himself for the poor and needy, for the relief of suffering, and the well-being of the community, in the exercise of their profession.

One of the distinctive features of our Society is to bring together, more than any other in this metropolis, or, so far as I am aware, in Europe, medical men of very varied training and experience. Besides many civil practitioners and members of the Medical Civil Service, the various militant branches of the public service are well represented, and more especially of late years that of India. Three most distinguished Presidents we owe to that service, and our published *Transactions* have been enriched by many valuable communications relating to Indian subjects. None of our discussions have been more animated or interesting than those on the nosology, etiology, and prophylaxis of Indian disease. Our retiring President brought to bear on them exact and profound knowledge, a mastery of facts and a truly philosophic breadth of view in judging them, which, conjoined with his genial

courtesy and power of lucid expression, pre-eminently fitted him to initiate and lead our debates on these important questions. I, for one, rejoice at the recent prominence of the Oriental element. India is ever a problem of absorbing interest, from the magnitude of the empire, its diversity of climates, races, and religions, and the marvellous system of paternal government which there flourishes, to the envy and admiration of the world. Of this system a most important share must always devolve on the medical profession, and whether in connection with the horrors of pestilence or famine, or with fairs and pilgrimages, or the gloomy forebodings of hostile invasion, sanitary questions invariably come to the front. The medical officer is a veritable apostle of humanity and civilisation, whose mission cannot be misunderstood, a living, moving proof of the truly beneficent nature of the English Raj, in caring for the wants and woes of the dusky millions whom Providence has committed to its rule. I can assure all Indian officers that here they will always be heartily welcomed, and every attention will be paid to the weighty communications they may have to offer. Their discussion will form one filament in the bond of union which connects our country with its vast Asiatic dependency.

In striking contrast has been the fate of the magnificent tropical empire acquired by the Spaniards in the sixteenth century. Avarice, bigotry, and remorseless cruelty, combined to exterminate in a few years two most interesting and advanced types of an ancient indigenous civilisation; and subsequently, indolence, apathy, and intestine wars have reduced the finest regions of America to almost primitive barbarism. Lands of exuberant fertility, with a salubrious climate, and capable, it is estimated, of supporting five hundred millions of mankind, remain, in the absence of a strong governing hand, for the most part unpeopled, waste, and unproductive. Yet even from this unpromising region valuable contributions to epidemiology have reached this Society; and in the first volume of our *Transactions*, memoirs of great interest are to be found on the outbreak of yellow fever and of hæmorrhagic typhus in the Andes, at abnormally high altitudes, and on diphtheria in Peru. Information is still wanted as to the diseases peculiar to certain localities in the tropical portion of the American continent. Of these, may be mentioned the Verruga, or malignant bleeding wart of Peru, an endemical exanthem which is strictly limited in its area to the western slopes of the Andes, between the 9th and 16th degrees of south latitude, at from 3,000 to 8,000 feet eleva-

tion from the sea. This remarkable disease seems to exist only in deep, narrow gorges, with precipitous sides of bare granite, and clay bottoms permeated by mountain streams whose banks are clothed with luxuriant vegetation. Where the valley widens, even a few miles below, the disease is not known. Great alternations of temperature occur in those ravines, in which the thermometer rises to 100° in the day, and falls to 65° at night. The malady consists in the eruption of vascular warty tumours on the extremities, face, head, and neck, very rarely on the trunk; while, in the more severe cases, the mucous membranes are also affected. Slow in development and bleeding freely, their number and the amount of hæmorrhage appear to be the measure of the patient's danger. They are preceded, it is said, for some weeks, by febrile debility, headache, acute pains in the limbs, and a peculiar cramp-like sensation of contraction in the gullet. But when the warty eruption appears these symptoms subside. The average duration of the malady is about three months, and the mortality among the natives appears to be 6 to 10 per cent. of cases. But new-comers, especially of European race, who take up their abode in those valleys, suffer far more intensely. It is said to have destroyed a fourth of the conquering troops of Pizarro in the beginning of the sixteenth century; and only a few years ago, a party of engineers and English navvies lost one-half of the former and three-fourths of the latter in seven or eight months, while employed in this region in constructing the trans-Andean railway. The etiology of this remarkable disease is as yet undetermined. It is believed to be non-contagious, essentially endemic in its nature, but to attain at times epidemic virulence, chiefly among foreigners who reside some time in the locality, and who seldom escape it.

Another, but in no way formidable, cutaneous disease peculiar to tropical America may be mentioned as worthy of further elucidation, the Pinta, or Mal de los Pintos. It appears to be restricted to the hot, low-lying regions of the west coast of Mexico, Central America, and to the river basins in the States of Venezuela and New Granada, and to be unknown where the mean temperature of the year is lower than 70°. The Tierra Caliente, and only that of the Pacific coast, and the banks of the rivers Madalena and Meta, are the chief seats of the malady, which is almost confined to the coloured races, and to the poorest and least cleanly individuals among them, but so prevalent that in some villages nine per cent. of the inhabitants are infected with it. Apparently of mycotic origin, it is characterised by piebald

coloured patches of black, blue, red, and white, giving the skin, in some cases, the appearance of jasper or variegated marble, and is probably due to the location of parasitic fungi ("*Champignons microscopiques*", their describer calls them) in the layers of the epidermis. It is attended with itching, and the patches are found of irregular size over the whole body, except the palms of the hands and soles of the feet, and appear first on the parts not covered by clothing. In favourable circumstances the disease is communicable; and some writers say it is preceded by febrile and other constitutional symptoms lasting a few days, and then by an interval of forty days before the spots appear. Professor Hirsch, however (from whose great work these particulars are taken), considers it doubtful whether this prodromal stage exists, and is at all connected with the skin disease, which seems to be a purely cutaneous affection, chiefly remarkable for its very limited geographical distribution.

On the eastern coast of South America a very formidable and fatal disease has appeared since 1864, first at Bahia and soon after at Para, Pernambuco, Maranham, and other ports of the Brazilian Empire, soon spreading inwards to provinces remote from the sea-board, and everywhere causing a heavy mortality. In the poetical language of Professor Feris, "Le Beribéri, immense vampire, étend ses ailes noires sur toute l'étendu du Brésil, du Couchant à l'Orient, et du Midi au Septentrion." The malady, in its main features, seems to be identical with that well known to many of our Indian physicians as endemic in the littoral of the Madras Presidency, and in the Island of Ceylon, which in the end of the last century and beginning of this was very fatal to our troops, and was considered to be of a purely endemial character. From its symptoms, anæmia, dyspnœa, dropsical effusions, and paralysis, it was classed among constitutional diseases. Death often occurred with appalling suddenness from embolism or syncope; and it is recorded that the mortality among the European troops amounted to 25 per cent. of those attacked, and that among the convicts in jails the proportion of deaths was as high as 37 per cent. The disease seized acclimated persons and old residents in tropical India in preference to new-comers, and was rarely found far from the coast. Beriberi is well known in other Oriental countries, in the great islands of the Malayan Archipelago, and in Japan. Recent researches in the ancient medical literature of China and Japan show that the disease was known and described 2,000 years ago, and the two great varieties of dropsical and paralytic were recognised and differentiated in Japan so far

back as the tenth century. At present, China does not seem to suffer from this disease, but in Japan sickness and mortality from it are still very considerable. Occasional outbreaks of epidemic character have occurred on board ships in the Indian Ocean, and in voyages, with coolies on board, between Asia and America. Cases have been noted in the West India islands and in Guiana, but it is in Brazil that beriberi has found a congenial home, and since 1864 has asserted its right to be deemed cosmopolitan. At first the new epidemic was not identified, and it seems to have been Drs. Paterson and Silva Lima who first recognised it, their opinion being confirmed by that of M. Le Roy de Méricourt, the distinguished editor of the *Archives de Médecine Navale;* and a most interesting account by Dr. Feris of the history of beriberi in Brazil is to be found in that periodical for the year 1882.

In some respects it differs from the same disease as known in Asia, in its being found far from the sea-coast, for in the war between Brazil and Paraguay both contending armies, as well as the river flotillas, suffered greatly, although several hundred miles from the sea. A new feature also is its attacking women, who suffer in Brazil in considerable numbers, and chiefly from the paralytic and nervous symptoms. The young of both sexes under 15, and the old over 65, seem to be exempt. In school dormitories striking instances often occur of youths being affected, while those a little younger, in beds side by side with them, escape. The duration of the disease varies very much, four to eight weeks being the average, but five days and seven months are quoted as occasional extremes, while the chronic form lasts for several months, and even years, with alternate remissions and exacerbations. It is in this condition that patients are sometimes sent for improvement on a sea-voyage to Europe, and either die on the passage or land at Liverpool and other ports. The proportional mortality of beriberi in Brazil to all other deaths is not definitely known, but it must be very considerable. In the war with Paraguay both the armies and fleets engaged were described as "decimated". The relative mortality to number of cases has varied from 74 per cent. at its first outbreaks at Bahia, 1864-66, to 13 per cent. in the hospitals of Rio Janeiro, when, after a few years, in 1869-75, its nature and treatment were better understood.

Notwithstanding the host of scientific observers occupied in the investigation of this formidable disease, its etiology is still obscure and controverted. The high temperature and humid atmosphere which mostly accompany its incidence are not

universal: and it has frequently been found in cool, dry, and elevated localities in both Brazil and Japan. The dietetic and quasi-scorbutic origin which the Dutch physicians are prone to give it, is founded on their experience of beriberi among the Malays in Sumatra and other islands, and lascars on board ship, whose food, often scanty, and consisting almost exclusively of rice and dried fish, is destitute of albumen and fat. But this pathogenesis cannot be accepted in India, and still less in Brazil, where many of the well-fed and comfortably placed inhabitants (both white and coloured) have grievously suffered. It has always been accounted an essentially non-contagious disease, yet Professor Feris and Dr. Silva Lima cite some remarkable instances which seem to be more than mere coincidences. Three French priests affected made a journey in the province of Minas Geraes, from Caraça to Diamantina, by way of Mariana, stopping at these places, and there, and at no other localities, the disease soon after appeared. Two women died of beriberi, and soon after their husbands were stricken with the malady. Two negroes were admitted to hospital for trivial surgical disorders, occupied beds which had been used by beriberi patients, and both were seized with it. Such cases are considered exceptional and inconclusive; yet the malady would seem capable of being imported, for its first appearance in the Antilles, Guiana, and Brazil was almost simultaneous with the first introduction of coolie labourers from Asia. Like cholera, it seems to be making the tour of the world, but is, as yet, limited in its sphere of habitat to tropical regions. Brazil, where epidemics were long unknown, has suffered greatly of recent years. Yellow fever first appeared in 1849 and cholera in 1855, at the very same ports where beriberi first attracted attention: whence it may be inferred that that comparatively flourishing empire has, like others, paid a considerable penalty for its commercial prosperity.

I had hoped for a paper on beriberi from our learned Secretary for Portugal and Brazil, Dr. Donnet, whose linguistic accomplishments and large experience would have given him unusual facilities for the investigation of this interesting subject, but he has declined the task, for the valid reason that he has not himself had any opportunity of seeing the disease. I venture respectfully to submit that some of our Anglo-Indian brethren who may have known it in the East would find its portentous extension and development in the South American Empire a theme well worthy of their consideration and further exposition. Their practical experience would add new zest and lustre to the recent valuable

literature on the subject, and be far more worthy of your acceptance than the very meagre sketch I have now laid before you,—founded, not, as I would have desired, on personal observation, but on the monographs of French and Brazilian physicians. During the few months I spent on the shores of the Gulf of Mexico and Caribbean Sea I saw no other endemic disease than the malarious fever of the country; and in 1842, when I was at Rio Janeiro, that magnificent port had been as yet unvisited by cholera, yellow fever, or beriberi.

I trust that this session we shall also be gratified by some communications on the saddest but most attractive topic of the year, the memorable expedition to the Soudan, than which there never was sent from England one more creditable to the medical officers who formed so important a part of it. The diseases occurring to European troops in that hitherto almost unknown region offer a deeply interesting subject of research. The incidence of enteric fever and dysentery, and the considerable mortality that attended the advance of our heroic army, and threatened at times to mar its efficiency, seem to require elucidation. Peculiar and novel features are described to have been manifested in the mode of attack, the progress of the symptoms, and the ulterior history of the cases, due, doubtless, to the unwonted and trying conditions and surroundings in which those brave men were placed, The Nilotic basin and adjacent desert constitute a new field of epidemiological observation, and we may look forward to being favoured with new and valuable information on East African diseases, and on the specific differences, if such exist, betwixt the bowel fevers of the Soudan and those of other portions of tropical Africa. Under the auspices of the distinguished Medical Director-General of the Army, who has formerly taken an active part in our proceedings, reports of unique interest and importance may be soon expected to be published, and we may venture to hope for much instruction and food for discussion in regard to them.

That fevers of abnormal and exceptional type sometimes occur, is vividly shown in the *Report on the Health of the Navy for* 1883, wherein is detailed the history of H.M.S. *Thalia*, on a voyage from England to China. She left Plymouth on the 3rd of January 1883, and on the 15th arrived at Malta. There, five cases of erysipelas appeared among the crew, three traumatic and two idiopathic, likewise some cases of erythema. By the Suez Canal and Red Sea route she reached Colombo in Ceylon, leaving it on the 22nd of February. Betwixt that date and the 16th of March, when she arrived at Hong-Kong, eighteen cases of continued fever had

occurred, of doubtful character, but supposed to be enteric, although few of the cases were attended with relaxation of the bowels. The ship was overcrowded with young men and boys, as relief crews for the ships of the China squadron. The *Thalia* is a wooden ship of 2,200 tons, with a spar deck. She carried a crew in all of 479. Of these, 215 were lodged on the main deck and 217 on the lower deck. Both decks were much overcrowded, especially the lower, on which the younger men and boys slept. It was, moreover, badly ventilated, and, in the hot weather of the Indian Ocean, had become close and offensive. The bilges had become foul, and the sanitation of the vessel was reported as defective. It was naturally inferred that this unwholesome condition of affairs, so unusual in Her Majesty's ships, had caused the outbreak of disease. And this view was confirmed by the fact that the great majority of the sick were derived from the lower deck, where the crowding was greatest, the ventilation worst, and the malodorous emanations most offensive. Fever seized a large proportion of the crew at Hong-Kong, where 46 cases were treated at the hospital, 38 of whom were betwixt the ages of fifteen and twenty-five, and had nearly all slept on the lower deck. The reliefs were drafted into the various ships, and many of them, after joining those vessels, were affected with the same *Thalia* fever which they had contracted during their stay on board her, although they were not attacked till after they had left her. The young were most often its victims, and some eighty cases are recorded to have occurred of this description after their migration to other ships. Attacks continued to occur till May, and some had not recovered in September.

This disease was neither contagious nor fatal, no death having to be recorded as resulting from it. Yet it was a most painful and distressing form of fever. Sudden in its onset, with chills and acute pain of the head and back, and high pyrexia, the temperature remained high, 104°, till the fourteenth day, when it began to fall, but in several cases continued at this height for forty days. Relapses were frequent. Of the forty-six cases at Hong-Kong Hospital, twenty-five had relapses, and some repeatedly. The bowels were generally confined, and the urine normal in quantity and quality. Delirium, tremor, and great debility were often found, but no marked eruption. The average duration of the attack was 145 days, convalescence being very slow, even when not interrupted by relapses. As a sequel, orchitis occurred in six, and rheumatism in forty cases. This fever can hardly be classed as typhus or as relapsing fever of the usual type,

for it was not communicable to those who had not been exposed to the local morbid poison of the *Thalia;* yet in most respects it resembled relapsing fever of Europe as to pain, tediousness, and non-mortality. It would seem to have been analogous to the old ship fever or typhus, so prevalent in the foul, overcrowded, ill-ventilated ships of the olden time, and, like it, affected the young in preference to the middle-aged, and notably those lodged in the part of the vessel most exposed to the deleterious influence of putrefactive fermentation in a hot climate. In one respect its pathogeny appeared to be analogous to that of the memorable, and far more serious, outbreak of fever on board the *Bristol,* after leaving Sierra Leone in 1865, inasmuch as those only who had lived in the poisonous, confined atmosphere of the tainted vessel—in that case, the *Isis*—suffered from it, and did not spread the disease to the crews of other ships whither they had migrated. The *Thalia* was cleansed and purified at Hong-Kong, some structural defects were remedied, and her ventilation improved. She returned to England with a reduced number of men on board, and without any symptoms of illness appearing among them that could be ascribed to sanitary imperfection in the ship. The cause of the epidemic was therefore not only local, but very temporary in its operation, and indicated the imperative need of diligent, anxious attention to hygienic details during the conveyance of numerous bodies of men in voyages of even moderate length. This instance is so interesting and typical, that I hope the Society will obtain for its *Transactions* fuller details than time will now allow me to submit, and more elaborate even than are to be found in the brief but admirable narrative of the report.

In the same year the naval records show a considerable but happily non-fatal epidemic of malarious remittent fever in the river Niger. An expedition ascended the river in October to attack a piratical town. The vessels were ten days in the river, and during their stay the health of the crews was very good. They were 283 in number, very great care was taken of their hygienic condition, and quinine was administered as a prophylactic while in the river. The vessels, on their leaving the Niger, on the 30th October, dispersed in different directions, but in the course of November cases of malarious remittent or intermittent fever occurred in all of them. The cases were 268 in number, being nearly the whole of the white force employed on the service; but they were readily amenable to treatment, one death and five invalidings constituting the entire loss. This great river highway to Central Africa is

obnoxious, as of yore, to endemic fever, as the normal hindrance to its navigation; but, fortunately, the resulting mortality is comparatively small when due precautions are observed as to the season of undertaking the ascent of the stream.

Some interesting statistics in the last Annual Report of the Royal Navy testify to the serious increase of the various forms of venereal disease on the Home station since May 1883, when an important clause of the Contagious Diseases Acts regarding the compulsory examination of prostitutes ceased to be enforced. The latter half of that year exhibited a very marked augmentation in the number of cases of syphilis, both primary and secondary, gonorrhœa, and epididymitis among the seamen and marines, averaging 22,000 men. The ratio of such cases for the year 1883 was 280 per 1,000; the number of men thereby disabled was 367 per diem, or 17 per 1,000 of the force employed. The mean ratio of the previous ten years had been 132 cases per 1,000 men, and the whole number on the sick-list from these disorders had given a daily average of 10.6 men per 1,000. These figures speak for themselves, and appear to show conclusively that in this particular the sanitation of the navy had retrograded considerably within a few months. It would be desirable to know whether the troops, many of whom are quartered in the naval arsenals, have similarly suffered; and I venture to suggest that some of our colleagues connected with the army and navy, who are interested in this important question, should give us the benefit of their experience at home and abroad, and more especially as to whether this regrettable deterioration in the health of the forces on the Home station may be considered as likely to be permanent, or as only a temporary evil.

In 1864, while the subject of protecting the servants of the State from those diseases was beginning to be mooted, and when these much controverted Acts were as yet only in embryo, I had the honour of submitting to the Society some observations I had the opportunity of making a few years before in China, which satisfied me as to the great utility and benefit of legislative measures of a preventive character when faithfully and honestly administered. Again, in 1866, I laid before the Society, in a paper on the Sanitary Condition of the Mercantile Marine, the expediency of protecting seamen in our great ports from those destructive maladies, which are more virulent in men so circumstanced, and tell in a more intense degree on after-health than when they affect the carefully tended and well-

treated men of the Royal services. I may be pardoned for thinking that this matter of the prevention and mitigation of enthetic disease is a branch of public medicine which comes within the scope of our deliberations; and that, at this juncture, when a very decided and unreasonable opposition to prophylaxis has for the time emasculated legislation thereon, the discussion of the points in dispute by thoughtful and experienced medical officers may be interesting to themselves and advantageous to the State.

The principal epidemiological events on the Continent of Europe during the present year have been the invasion of Spain by cholera, and its recrudescence in Southern France, Italy, and Sicily.

Last year, Spain escaped almost unscathed, but in May of this year the disease broke out at Valencia, and has thence appeared to spread over the whole kingdom, few provinces or great towns having been free from its ravages. The mortality is estimated at 100,000 deaths in the six months, or 6 per 1,000 of the entire population. The cases have been supposed to be 300,000 in number; but such attempts at registration must necessarily be imperfect, these epidemics, in most countries, comprising many cases of choleraic or even simple diarrhœa, co-existing with the more terrible and fatal form of pestilence. Everywhere, by the accounts given in the journals, the disease has been associated with impurity of water and defective sanitation. Such towns as had a wholesome supply of water and better drainage suffered but lightly compared with those in which these all-important matters were neglected. Madrid, Barcelona, and Seville are instances of the former; Valencia, Granada, and Aranjuez of the latter. The first cases in Madrid occurred on the 20th of May, and 1,000 persons, or 2 per 1,000 of the population, are stated to have perished in the epidemic, which fell, however, on limited districts of the city situated at the lower level, inhabited by the poorer classes, and noted for their insanitary condition. Some of the sewers are described as elongated cesspools, with brick walls of so porous a quality as to permit free percolation and leakage to contaminate soil, air, and water. And although pure water from the distant hills is supplied in abundance to fountains all over the city, too often, through ignorance or indolence, water from old wells is said to be still sometimes used in the houses of the poor; and it was observed that on such premises the disease was most virulent. The greater part of the city, enjoying a copious supply of pure water, and fairly well drained, remained uninjured. The sewage of the capital finds

its way to the small river Manzanares, and thence to the Jarama, an affluent of the Tagus at Aranjuez, some thirty miles to the south; and this town showed an appalling mortality, one-fifth of its population having been swept away. The invasion was sudden and rapid. The first victims are said to have been labourers from Valencia and Murcia, who, working in the fields, drank water from the Jarama. In thirteen consecutive days 785 deaths occurred, the maximum number, 135, being on July 6th. In the confusion and panic of such an outbreak all sanitary arrangements were overwhelmed. Dejecta and polluted clothing were carelessly thrown out, and intensified the spread of the disease. In Toledo, further down the Tagus, with 20,000 inhabitants, in a salubrious site, 2,400 feet above the sea, the malady appears to have been combated with energy by the local authorities, and only 100 cases, with 60 deaths, are said to have occurred in the summer months; but this city had been visited in the previous autumn by an epidemic of equal severity, beginning in September and lasting to December, although the temperature had fallen to that of frost and snow.

The great Spanish elevated plateau of 2,000 to 3,000 feet above the sea level forms about one-half of the kingdom. This immense plain is traversed by parallel mountain chains, running transversely from east to west, forming the watersheds, and bounding the basins of the great rivers that flow westward to the Atlantic. The banks of these rivers are fringed with fertile lands and cultivation, and considerable towns; but the plains above are arid, sterile, and treeless, parched in summer, and swept by icy blasts that blow for more than half the year with piercing keenness. "Nine months of winter and three of hell", is the proverbial description of the climate of this extensive region. With few railways or other roads, and a limited traffic, it would seem to be unfavourable for the dissemination of a disease generally found to follow in the track of human intercourse. Yet the morbid poison has been rapidly diffused over the country, and in localities of *primâ facie* most healthy character. A very notable circumstance of this epidemic is that it has not as yet extended into Portugal, and in the last great cholera epidemic that afflicted Spain in 1865, Portugal was almost equally exempt. Now Spain and Portugal form but one geographical region; the great physical features of the land, the ranges of mountains, the elevated plains and the rivers, are all continued on the west into Portugal, where they fall by a gradual slope into the Atlantic. Nor do the climates

essentially differ, save that on the western sea-board, and near it the air is more humid, and the temperature necessarily less extreme. The habits of the people are also much alike, and sanitary science is cultivated, or practised, even less in Portugal than in Spain. No natural boundaries exist between the two countries, which are conterminous for about 500 miles. The frontier is an ideal line, with the usual custom-houses and military posts of the two nations confronting each other on the rivers, railways, and roads at the boundary point of intersection. The epidemic that ravaged Spain in 1865 first appeared, like that of this year, at Valencia, whence it spread over nearly the whole of the kingdom. Dr. Hirsch considers it proved that on that occasion it was brought by a traveller from Alexandria *viâ* Marseilles, and was therefore of Levantine origin. It began in July 1865, and reached Badajos, near the Portuguese frontier, in October, whence it crossed into Portugal to the great fortress of Elvas, and also appeared at Oporto; but the cases were few in either place, and the smaller kingdom may be said to have had immunity from the disease.

In former epidemics of cholera affecting the Iberian peninsula Portugal had greatly suffered, in 1833 and 1853, in common with Spain, but both countries entirely escaped the epidemic of 1849. The earlier invasions were both from the north-west, the first cases being at Oporto and Vigo, whence they were to be traced all over the country, and were believed to be introduced from England, which had on those occasions received the disease from Russia *viâ* Germany, by what may be called the north-east route. The Portuguese are, therefore, always apprehensive when cholera is visiting this country. How it does not reach them from their close neighbour, Spain, seems inexplicable. One-half of the Spanish territory is drained into Portugal by the great rivers Douro, Tagus, and Guadiana on their way to the ocean. It may be that their waters have become purified by their rapid flow through the thinly peopled pastoral lands on the frontier, or that a very limited commercial traffic at all times exists in that part of the country. It can hardly be supposed that a strict sanitary cordon, maintained, though it be, with mediæval rigour, and repelling *vi et armis* all persons and goods from infected places from entering the Portuguese territory, could be so efficiently carried out over an extensive boundary as to be successful in excluding so subtle and mysterious a disease. The Portuguese Government congratulate themselves on their rigid surveillance. Railway passengers, cattle, goods, are still subjected to detention for some days, and to this vigilance they ascribe their safety.

All such exemptions from the apparently natural diffusion of the disease, when unchecked by energetic sanitation, are worthy of most attentive consideration. One of the unsolved mysteries of cholera is the remarkable immunity hitherto enjoyed by some places, in our own and other countries—as, for instance, by Cheltenham and Birmingham in England, and by Lyons, Rouen, and Versailles in France—even in pre-sanitation days; and the exemption of so considerable a kingdom as Portugal, while two epidemics were raging at an interval of twenty years in the conterminous State, seems to be a matter deserving full investigation.

It seems inexpedient to refer, except in the briefest terms, to the experiments on inoculation for cholera, that have been performed by Dr. Ferran and his coadjutors in Spain, with the view of counteracting or mitigating the virulence of the morbid poison. Opinion seemed, for a time at least, to have been divided as to the results, but by the last accounts the balance of evidence appears to be unfavourable to the operation. Besides many of the vaccinated having died of the disease, serious local symptoms of inflammation and blood poison are reported to have followed the introduction of the cholera matter, and the reputation which, like most novelties, it acquired for a season seems to have already vanished.

The interesting question of Asiatic cholera having for its essential cause the so-called Comma Bacillus described by Dr. Koch, has been much disputed, and the report of two eminent histologists, who proceeded from London to India to investigate the matter on the spot, has been decidedly adverse to Dr. Koch's theory. Their opinion has been confirmed by a commission of distinguished experts in this country, who, after careful consideration of the experiments and arguments of Drs. Klein and Gibbes, have accepted them as correct. Doubtless much controversy will yet be expended on the subject of microbes in relation to the etiology of cholera. In this epoch the microscope, in its application to pathology, is credited with great and growing importance, and will furnish material for much interesting discussion here and elsewhere on this subject.

Reverting to our own country, the only epidemiological points of recent date that seem to demand a cursory notice are the remarkable outbreak of diarrhœa at Hull in March and April, and the severe visitation of small-pox in London and its Essex suburb of West Ham, with varying intensity, during the last twelve months.

The epidemic at Hull was chiefly notable for its extent rather than its severity. Betwixt the 22nd of March and

the 10th of April it is computed that at least 20,000 cases of diarrhœa occurred in that great seaport town, or about ten per cent. of its population. Most of these were comparatively mild and tractable, but in some instances the bowel disorder was accompanied by cramps and other alarming symptoms, although happily there was no undue mortality—only nine deaths in four weeks. Considering the extensive diffusion of the disease, this is remarkable. The onset was sudden, and the cases were confined to persons residing within the area of the "Hull water-supply". Those who used the water of other districts of the town, having a separate supply, escaped. Contaminated water from a foul sewage-tainted stream had been permitted to mingle with the town supply, and the case presents a warning example of the great risks of such carelessness, and the necessity of vigilantly safe-guarding the community from what might have proved to be extreme peril.

In 1883 the deaths from small-pox in London had fallen to the number of 134, giving the low rate of 34 in every million of inhabitants. In the previous year, 1882, the mortality rate was 107 per million; but in the preceding year, 1881, when the disease attained epidemic virulence, it had risen as high as 600 per million. Thus, in three years, the mortality from this disease had varied exceedingly, eighteen times more victims having fallen in 1881 than in 1883; and by legitimate inference, the number of cases occurring in London may be estimated as proportionately decreased in the period. Before the year 1881 the most destructive epidemics were in 1877, when the death-rate was 714 per million, and in 1871, when it had risen to the portentous figure of 2,500 per million. But, in the intermediate years, small-pox was either non-existent or far less fatal, as in 1874 the mortality was so low as 20 per million, and in 1875, 23 per million. Last year, 1884, the deaths in the metropolis from this cause were 1,250, or 310 per million, and the mean annual rate for the last eight years has been 297 per million. Season is well known to have a powerful influence in determining the incidence and mortality of this exanthem. The seasonal curve is generally lowest during the months of July, August, September, and October. It begins to rise in November, and, be the epidemic great or small, continues high till the middle of June. Last year and this have been no exception to this rule. In September 1884 the mortality of the week had fallen to ten deaths, and the number of admissions to the asylum hospitals to 65, but both increased *pari passu* in the last quarter of the year, during which the

deaths were 560 in number, and the admissions to hospital 2,600. In the winter and spring months the higher ratio was maintained, 5,326 admissions to hospital having been recorded in the half-year from January to July, and 1,731 deaths, the majority in January, February, and May. In July a marked mitigation began to take place, and in the last week of September the number of deaths had again fallen to a minimum of six per week, and of hospital admissions to 32 per week. The whole annual cycle from October 1st, 1884, to October 1st, 1885, yielded 1,920 deaths in London, and 8,700 admissions to the hospital asylums. If, as is probable, twice as many cases occurred of slighter character, or were detained at home for medical treatment, the death-rate on the whole number of cases would be 1,920 in 26,100, or 7 per cent.—a comparatively small mortality, when it is considered how large a proportion of the community remain, through default of parents, unvaccinated, and how few persons, through ignorance, indolence, or perversity, avail themselves of the opportunity of re-vaccination in adolescent or adult life.

In that department of the Civil Service of which I have medical charge, the salutary regulation is enforced of all candidates for admission to permanent employment producing proof of re-vaccination. I have had occasion to examine, in the last three years, 250 adults and boys who have been thus re-vaccinated, and of the whole number I found only 18 in whom the second operation was not successful, notwithstanding their having two, and in some cases four, good cicatrices of infantine vaccination. In not more than three or four of those men and boys did any undue inflammation or other untoward result occur from the operation, although many of them were engaged in manual labour in various capacities at the time. Of the 250 examined—persons from all parts of the United Kingdom—nine who had been vaccinated in infancy had subsequently been attacked with small-pox, and of those who had been vaccinated and re-vaccinated, only three had small-pox in after years. None of these twelve individuals bore any conspicuous or disfiguring marks of the disease—an indication that the attack had not been very severe. In the epidemic we have passed through, the Essex suburb of West Ham suffered much. Being in close proximity to the docks, many poor persons, labourers and others, immigrants from Ireland, Wales, and other remote parts of the kingdom, inhabit this locality, the population of which is stated as 200,000, a larger proportion than usual of them being doubtless unprotected by vaccination.

In the year we have been discussing, from October 1st, 1884, to September 30th, 1885, the mortality from small-pox in West Ham amounted to 800, or nearly one-sixth of the whole mortality of the district. In some weeks more than half the deaths are recorded to have arisen from this cause. If the ratio assigned to London, of seven per cent. mortality on the whole number of cases, prevailed in this ill-fated locality, the number of persons affected would have reached the startling figure of 11,000 out of a population not exceeding 200,000. In the absence, however, of registration, this cannot be positively asserted; and the proportion of very severe and fatal cases was undoubtedly much higher than in the contemporaneous epidemic within the limits of the metropolis. While the mortality in London from small-pox in the period may be stated as not much exceeding the rate of 400 per million inhabitants, the death-rate of West Ham from this epidemic may be computed at the rate of 4,000 per million.

Vaccination and re-vaccination are unquestionably the only safeguards against such terrible outbreaks, and it is a matter of deep regret that so much fanatical opposition should be enlisted against the salutary laws enjoining the former, and against the extended practice of the latter. With the exception, perhaps, of vegetable acids as a preventive of scurvy, no prophylactic in medical science has been proved to be so eminently successful. That a loathsome, and often fatal, disease can, in so simple and harmless a manner, be averted or greatly mitigated, appears to be incredible to some minds, in an age when excessive credulity often exists side by side with irrational unbelief. We can only hope that the diffusion of sound education and true enlightenment, founded on the cultivation of the natural sciences, may in time overcome the ignorance and bigoted prejudice that resist those legislative measures which, if fully carried out and extended to adolescents as well as infants, would, in all probability, relegate these great epidemics of small-pox to the history of the past.

In a few exceptional cases there is, doubtless, an extraordinary individual susceptibility to this morbid poison, just as there are, on the other hand, a considerable minority of persons who appear to resist it and remain unaffected, even when fully exposed to it. Instances of this kind in small-pox and in other diseases are familiar to all experienced practitioners. I may perhaps be permitted to refer to an outbreak of small-pox which I had the opportunity of observing in the flagship on the coast of Central China, in the hot season of 1859, in circumstances when isolation or separation

was at the time impracticable; and when, therefore, during the month the epidemic lasted, every one of the 550 persons on board might be considered to be exposed to the infection. Of the forty-four cases which occurred, all, save one, bore the marks of infantine vaccination. This one was the first case, very severe, confluent and fatal. He was a native of a remote island of the Hebrides, where probably there was no medical practitioner, and rarely any opportunity for vaccination. Only one other died, but of dysentery, during convalescence from the small-pox, which was not unduly severe. One-fourth of the whole number of cases exhibited copious confluent eruption, high, recurrent pyrexia, and general severity of symptoms. In the remainder the eruption was sparse and discreet, and the accompanying fever moderate. In some cases only a few pustules appeared, with brief constitutional disturbance. Re-vaccination was comparatively rare in those days, and none of those attacked had, so far as I could ascertain, submitted to it. A very careful examination of the ship's company was made, and a few, not more than five or six men, were found on whose arms no cicatrices of vaccination could be detected; but none of these, although fully exposed to the contagion, were attacked. Whether those persons were vaccinated or not is of course uncertain, but no mark of it could be discovered. If this small epidemic were typical of what occurs on a larger scale, it would serve to show that in predisposing circumstances, such as over-crowding, etc., a focus of contagion, accidentally introduced into a community, might affect as many as ten per cent. even of vaccinated persons exposed to its influence. Re-vaccinated persons doubtless suffer in a greatly diminished proportion. Only one instance occurred in my experience in 1872, of a man who had been vaccinated and re-vaccinated dying of the disease; and this was the more remarkable, as only two years before he had with impunity been daily in contact with a relative who laboured under a severe attack of small-pox. His age was only thirty-four; and this matter of age is of considerable importance in determining the expediency of repeating the operation as life advances. It is very desirable that details of the ages and other particulars of the numerous victims of the recent epidemic in the circumscribed area of West Ham should be utilised, and I hope that some of our colleagues may have the opportunity of investigating them, and of giving the Society the benefit of their researches.

Although my daily labour for many years has chiefly been in the east and south of London, where zymotic febrile diseases have always been more prevalent and fatal than

in other quarters, it has been my fortune to see comparatively little of them. Only 7 per cent. of the total amount of sickness among those in my professional charge has arisen from such diseases, and in several years the zymotic ratio has not exceeded 4 or 5 per cent. Living in the better streets, in comfortable small houses, well ventilated and fairly well drained, with, as a rule, the water-closets, sinks, etc., outside the premises, these persons and their families have suffered but little even in the epidemics that have sometimes fallen with considerable weight on their immediate neighbourhood. And in evidence of the general gradual improvement that has been taking place in the sanitary condition of our London suburbs, I am glad to be able to state that in recent years the number of cases of diseases usually associated with sanitary defects has steadily diminished. Thus, taking a period of twenty years, it is found that in the first ten years there occurred twenty-four cases of enteric fever, with two deaths; but in the second ten years only nine cases, and no death. Of typhus, eleven cases are recorded in the first ten years, and six deaths; but in the second ten years not one case. Of intermittent fever, twenty-four cases in the first period, and only six in the second; of relapsing fever, only one case in 1869, when it was epidemic in London, and which had a fatal termination. Of erysipelas, the distribution has been less unequal, showing twenty-seven cases in the first, against twenty-four in the second period, with two deaths; most of these, having been of traumatic origin, from injuries of the head, etc., have not much importance as a test of insalubrious environment, and I have never seen the disease communicated to others residing in the house; and the same may be said of the enteric fever occurring in the time.

Febricula, generally from insolation in summer, or exposure to cold at other seasons, can hardly be accounted a zymotic malady, but in the first period 180 cases are noted against 111 in the second. Dysentery showed 18 cases in the first period, only nine in the second. Like these, diarrhœa can hardly be accounted a zymotic disease. Occurring, as it does, for the most part in summer, its etiology has been generally determined by rise of temperature or errors in diet. In 1866, however, it prevailed epidemically at the same time as cholera, sixty-five cases having occurred that summer of considerable severity, and ten of them exhibiting the graver symptoms of choleraic diarrhœa. But only one case of decided cholera appeared among the Customs officers, and that in a young man resident in Bermondsey, who may

be said to have induced it by taking unnecessarily a brisk purgative, which caused hypercatharsis, followed by alarming algid symptoms and collapse. He rallied from this condition, but subsequently died on the tenth day, from consecutive fever. Although 600 of those officers lived at that time in the Tower Hamlets, which suffered far more from cholera than any other part of London, they and their families, amounting to about 3,000 persons, escaped. This immunity is the more remarkable, as many resided in the streets which suffered severely, and all drank the water which was blamed, and doubtless with justice, for the dissemination of cholera in the east of London. Small-pox has been the gravest form of zymotic disease in the Customs force, fifty cases of illness and six deaths having been thereby caused in the twenty years under review. This does not seem to be an excessive proportion in a corps composed of more than 2,500 individuals, and in a period during which London has been visited by one formidable and two considerable epidemics. The fatal issue, in more than one instance, was probably determined by the fatigue and exposure of a long journey, say from Poplar to Highgate, to reach the hospital asylum, in cases when the moderate amount and non-confluence of the eruption had led to the hope that the attack might be surmounted. Revaccination being now insisted on for all entrants to the service, the ratio of small-pox may be expected still further to diminish; and it may be remarked that in the epidemic which so cruelly devastated West Ham in the earlier half of this year, not a single case occurred, although many officers live in that quarter, as conveniently situated for their duties at the docks. Typhus some years ago was occasionally met with, but no case has been recorded since 1870, and no death has been due to that cause since 1868. Relapsing fever has not been seen since 1869, when one fatal case occurred. No instance of diphtheria has ever been observed in this body of men during the twenty-eight years in which an exact registration of all cases of illness has been carried out.

It may therefore be inferred that the diseases which it is mainly the province of this Society to discuss, are of less personal importance to adult males, or what may be termed the bread-winning class of the community, than are those constitutional and local maladies which form the bulk of medical practice, and are the chief source of mortality and premature disablement. Among those officers I have mentioned, who may be considered a fair type of a large section of our population, four or five per 1,000 perish annually from

phthisis, and as many more from various forms of organic disease of lung, heart, brain, and kidney. But in the whole period of a quarter of a century the group of zymotic and febrile diseases has not destroyed in each year more than one per 1,000, and in the last ten years not more than one per 2,000; the annual mortality of the force averaging twelve per 1,000 from every form of disease. It is only when, by default of energetic preventive measures, storms of pestilence sweep over the land, that adult life, at least among men, is very seriously affected. Infantine and early life are so susceptible to the subtle contagion of zymotic maladies, and so imperilled by them, that it is a matter of deep congratulation that in this particular a very great amelioration has of late years taken place, shown in the gradually decreasing death-rates of London in the last five years, from 21.7 in 1880 to 20.3 in 1884; falling a few weeks ago, in the last week of September, to the marvellously low and unprecedented mortality of 13.8 per 1,000, only 1.8 per 1,000 being from zymotic diseases. The deaths from the whole group were but 145 in number, being 100 below the average of that week.

Except in periods of unusually low temperature, when pulmonary diseases are prevalent and fatal, and those debilitated by other illness more readily succumb, the mean adult mortality fluctuates but little. But from birth to five years of age extremes of temperature are especially destructive. Thus, for instance, in the hottest week of last summer (on the whole a cool and dry season) the thermometer rose to 90° Fahr., and the mean temperature was 65°; 348 deaths were recorded from diarrhœa, and the public mind was agitated by fears of coming cholera; but on analysing the tables, only sixteen of those deaths were in persons over five years of age; and of those sixteen, eight were in persons betwixt 60 and 90. The general population was therefore singularly free from bowel disorder, so far as it can be estimated by deaths. Yet the total deaths of the week were raised by this infantine mortality to 1,750, or the rate of 22.4 per 1,000, although only 475, or one-fourth, of those deaths occurred in persons betwixt five and sixty years.

Again, let us take the first week in January (one of the coldest weeks in a mild winter), when the thermometer fell to 25° Fahr., and the mean temperature was 30°, we find that the mortality from all causes attained the high figure of 1,956, or the annual rate of 25 per 1,000, and that the deaths from chest affections of all kinds amounted to 978, or 100 above the mean, and exactly one half of the whole; but of those latter, 349 deaths, or 36 per cent., were of persons above

sixty; 216 deaths, or 24 per cent., were of children under five years; and only 393 deaths, or 40 per cent., occurred from respiratory disease in the wide range of the London population between the ages of five and sixty years. The total mortality of the week shows the same inequality, being in the old, 636, or 32 per cent.; in young children, 559, or 29 per cent.; and in those aged from five to sixty years, only 761, or 39 per cent. Those weeks were respectively the most fatal both of the winter and the summer seasons, and coincided with the extremes of temperature recorded in the year. It may therefore be inferred, although it does not strictly follow, that they were the most unhealthy. But a heavy amount of sickness is not unfrequently found in connection with a low mortality when the type of the prevalent disease is not severe. Of this we have just seen remarkable instances in the *Thalia* fever in China, the river Niger fever, and the recent epidemic at Hull, all of which exhibited a high rate of illness with few or no deaths.

In our variable climate atmospheric vicissitudes must always be reckoned a principal factor in the causation of disease; the hereditary proclivity to various forms of constitutional disorder, and the habits and propensities of individuals, are also most potent elements in etiology. Sometimes these causes are combined, as in gout, of which I encounter a good many cases, averaging thirty in a year. With few exceptions it is of hereditary origin, the individuals themselves being in poor circumstances, leading laborious, active, open-air lives, for the most part abstemious, and sparing in the use of animal food and fermented liquors. It occurs at all seasons of the year, but perhaps most often in February and March, and is sometimes quasi-epidemic in its incidence, apparently by reason of sudden changes of weather. For example, a few weeks ago, in the end of September, four cases of gout occurred on the same day, in men of different ages, and variously circumstanced as to residence, occupation, and mode of living. Similarly, four cases occurred together in the second week of July, and five in the last days of March and beginning of April, apparently due in part to abrupt climatic changes. There is considerable variation in the prevalence of this disease in various years. In 1881 and 1882 I had seventy cases; while in 1883-84 there were only thirty-three. This year has been favourable to the development of gout, thirty-five cases having already occurred since the 1st of January. I will not weary you with the statistics of a disease which does not quite come within our purview as

epidemiologists, but which may be of some interest as showing that this malady, generally attributed to luxurious, inactive habits, and dietetic errors and excesses, is frequently not directly connected with them, although probably almost always traceable to inheritance from self-indulgent progenitors, and is greatly influenced by the same climatic changes that regulate, to some extent, the appearance and disappearance of the so-called zymotic diseases.

In this connection, as showing how obviously heredity influences gout, I may mention that, although several hundreds of men of Irish birth have been under my supervision, and also many Scotchmen, I have hardly found an instance of the disease occurring among them, notwithstanding their mode of life in London does not differ, in regard to the consumption of butcher-meat and malt liquor, from that of the people of this country. Excess in those articles, with insufficient exercise, would probably develop in time the same morbid condition which affects in more or less intensity so many persons of English nationality.

Rheumatism, the most afflictive and disabling of all the diseases of our climate, fluctuates also much in amount from year to year, being in some twice or thrice as frequent as in others. Of late years, 1868 and 1876 were as remarkable for the number as 1869, 1873, and 1875 were for the paucity of cases. It seemed almost to disappear during the cold dry weather we had some winters ago, notably in 1878-79, 1879-80, and 1880-81; being replaced, however, in many instances, by the still more formidable pulmonary diseases, bronchitis chiefly, with which rheumatism is so often connected.

The registration of disease, if at all attainable, would throw desirable light on the etiology of many diseases which, from being rarely directly fatal, cannot be estimated at their due proportion. Such records as I have accumulated, although on a small scale, relating to some 15,000 cases, possess the advantage of being based on a personal knowledge of the history and surroundings of the patients, and of the result of their illness, and may possibly, on some future occasion, form the ground-work of a communication to the Society.

Meanwhile, I fear I have already trespassed too much on your patience. I therefore beg to thank you, gentlemen, for the attention with which you have so kindly favoured me in this slight sketch of a few of those epidemic and endemic diseases of recent occurrence that seem to deserve notice at the hands of the Society. I have

endeavoured to suggest that some might be with advantage brought before us in fuller detail than space can generally allow in the blue-books of the public services, and in the cursory notices of the journals. Incorporated in our *Transactions*, such histories may furnish useful data for future reference. It is our mission to collect trustworthy evidence on etiology, and to investigate all facts and circumstances relating to outbreaks of preventable disease. It is the duty of our various sanitary authorities to enforce the salutary laws now existing, and of our legislators to amend them, if required, in the interest of the community, regardless of the self-interest and avarice that now too often successfully obstruct their due execution. At present the sanitary reformer is frequently

> "Like one lost in a thorny wood,
> That rends the thorns and is rent with the thorns;
> Not knowing how to find the open air,
> But toiling desperately to find it out."*

It is calculated by well-informed persons who have closely studied the subject, that, without any further demand on the already oppressed ratepayer, a far more efficient and economical administration might be devised, to supersede the present confused, divided, and perplexing muddle which cannot be fairly called organisation. In such a system the medical officer should have a firmer and less dependent position than now falls to his lot, too frequently, through the ignorant apathy or selfishness of those whose pecuniary interests are opposed to improvement in the dwellings, food, drink, and general condition of the poor, but who often, in the struggle for local position, obtain power and influence for which they are unfitted, and which they sometimes abuse. In the great political changes that are now going on around us, let us hope that reform of local government, in relation to public health, may find a conspicuous place, to the still further improvement of the sanitary condition of the country.

* Shakespeare, *Henry VI*, Part iii, Act 2.

THE GERMAN VACCINATION COMMISSION.

By E. J. EDWARDES, M.D.(Lond.), M.R.C.P.(Lond.).

(*Read: December 9th*, 1885.)

The object of this paper is to give a summary of the Report of the German Vaccination Commission of 1884, and of the statistics which accompany it, showing the effect of compulsory vaccination in Germany since 1874, at the age of twelve years. The following letter, which is prefixed to the Report, explains why the Commission was appointed.

"Berlin, *January 9th*, 1885.

"The opinion formed during the carrying out of the Vaccination Law of April 9, 1874, that vaccination is at times attended with danger to the health of the individual vaccinated, has already for several years induced a closer observation of the circumstances which cause these injurious effects, and of means for warding them off. The investigations carried on in the Imperial Board of Health Office plainly show that the fault lay partly in the selected lymph, in particular the human vaccine lymph, hitherto chiefly used, and partly in the neglect of necessary precautions by the vaccinators. The Imperial Board of Health, therefore, entered into a closer examination of the questions of the introduction of animal lymph into universal use, and of the institution of a systematic supervision of the work done by public vaccinators. Moreover, the Petitions Committee of the Reichstag, in its deliberations upon the petitions before it for the abolition of compulsory vaccination, repeatedly expressed itself in a similar sense.

"The lesser preservability and lesser certainty of effect of animal as compared with human lymph constituted an impediment to its general introduction. Later on, the Imperial Board of Health learnt that measures for overcoming these objections had been discovered. These measures were tried, and the favourable results which were obtained made feasible the general use of animal lymph. From the importance of the subject, however, it seemed desirable to lay the whole question (together with the scheme for the institution of an efficient supervision of the results of public vaccination) before a committee of experts.

"Meanwhile, the Reichstag, in its discussion on the petitions against compulsory vaccination on June 6, 1883, expressed its desire that the present physiological and pathological status of the vaccination question, more especially as regards the precautions fitted to ensure the greatest possible security to the health of the vaccinated individual, should be referred to a committee of experts in the subject; and that they should draw up a code of rules aiming at such security, with the eventual general use of animal lymph. They were, moreover, to arrange for the institution of a useful small-pox statistic, on the basis of obligatory returns, for the respective departments of the empire. The task before the Commission was increased.

"The Commission was composed of delegates from the Imperial States chiefly concerned, and by the addition of three anti-vaccinators versed

in the subject, care was taken that the statements of those opposed to vaccination should be fairly heard, so far at least as those statements rested on scientific grounds.

"In the course of its deliberation in the Imperial Health Office, Berlin, October 30 to November 5 of last year, the Commission arrived at the conclusions which I have the honour to present to you (the Bundesrath), with accompanying papers.

"The Report comprises, therefore—

"I. The protocol of the Commission, which includes:—1, List of agenda laid before the Commission; 2, Memorandum on the necessity of introducing animal lymph into general use; 3, Tables showing the effect of the Vaccination Law (with charts); 4, Summary of deaths from small-pox in Germany from 1875 to 1881, with two maps; 5, Two maps, showing the extent of the use of animal lymph in 1879 and in 1882.

"II. Vaccination statistics for the Empire, for 1882, with summary from 1876.

"VON BOETTICHER,

"*For the Imperial Chancellor.*"

The Commission numbered eighteen, all of whom, the President excepted, belonged to the medical profession. Their names were as follows:—Herr Köhler (President), of the Home Office, Berlin; Dr. Koch, of the Imperial Health Office, Berlin; Dr. von Scheel, of the Statistical Office, Berlin; Dr. Eulenburg, of the Prussian Medical Ministry, Berlin; Dr. Pistor, of the Police Presidency, Berlin; Dr. Grossheim, of the Prussian War Ministry, Berlin; Dr. Kranz, Central Public Vaccinator, Munich; Dr. Siegel, Medical Councillor, Leipsig; Dr. von Kerchensteiner, of the Bavarian Ministry, Munich; Dr. von Koch, of the Würtemberg Medical College, Stuttgart; Dr. Arnsperger, of the Grand-Ducal Baden Ministry, Carlsruhe; Dr. Reissner, of the Grand-Ducal Hesse Ministry, Darmstadt; Dr. Thierfelder, of the Grand-Ducal Mecklenb.-Schwerin Ministry, Rostock; Dr. von Conta, of the Saxony Ministry, Weimar; Dr. Krieger, Sanitary Councillor, Strasburg; Dr. Boeing, physician in practice, Uerdingen; Dr. Weber, physician in practice, Cologne; Dr. Betz, physician in practice, Heilbronn. Of these, Dr. Pistor was absent all through, owing to illness. The three last named were opposed to compulsory vaccination, Dr. Betz being opposed to vaccination in any shape. Dr. Boeing was a public vaccinator himself.

Eight agenda, drawn up in the Imperial Board of Health, were presented to the Commission for deliberation, and as a basis to go upon. The first and most important consisted of eight questions. The following are the conclusions arrived at by the Commission, in nine sets.

Conclusions of the Commission.

I.—*Conclusions respecting the present Physiological and Pathological Status of Vaccination.*

1. With rare exceptions, one survived attack of small-pox confers immunity against subsequent attacks (voted by 12 *v.* 3; 2 abstaining).

2. Vaccination exerts a similar protection (voted by 12 *v.* 2; 2 abstaining).

3. The duration of the protection afforded by vaccination varies within wide limits, but is on the average ten years.

4. At least two well-developed vaccine vesicles are necessary to ensure an efficient protection.

5. Revaccination is necessary ten years after primary vaccination.

6. The vaccinated condition of the community increases the relative protection against small-pox acquired by the individual by vaccination, and hence vaccination is beneficial, not only individually but generally (12 *v.* 1; 2 abstaining).

7. Vaccination may have an injurious effect, under certain circumstances. In the use of human lymph, the danger of transferring syphilis, although extremely slight, cannot be entirely excluded. Any other bad effects are apparently due only to accidental wound-diseases (all, except 3 abstaining).

All these dangers may, by precautions in the performance of vaccination, be reduced to such a minimum as to make the benefit of vaccination infinitely outweigh any possible injurious effects (all, except 3 abstaining).

8. Since the introduction of vaccination, no scientifically provable increase of any particular disease or of the general mortality has occurred, such as might be looked upon as a consequence of vaccination (all, except 1 abstaining).

II.—*Conclusions on the Introduction of Animal Lymph into General Use.*

1. Since the dangers to health and life (vaccination-syphilis, vaccination-erysipelas, etc.), occasionally connected with the use of human lymph, can be avoided by the use of animal lymph, so far as any direct transference of syphilis or of accidental wound-diseases is concerned, and since vaccination with animal lymph has been recently so perfected as almost to equal vaccination with human lymph, the latter is to be superseded by animal lymph.

2. This is to be effected gradually, and (by the aid of experience already gained) institutions are to be established

for the provision of sufficient animal lymph. When its supply is thus secured, public vaccinations are to be performed with such lymph.

3. The following are to be the guiding principles of such institutions: (*a*) each one is to be under medical superintendence; (*b*) lymph will be supplied gratis and post free to public vaccinators; (*c*) it will be permissible to use "retro-vaccine", in place of the so-called genuine vaccine-lymph; (*d*) lymph is not to be sent out to vaccinators until the previous health of the animal yielding it has been shown to be good, by a *post-mortem* examination (after slaughtering); (*e*) special instructions will be given as to the age and mode of rearing of the calves, the time and manner of removing the lymph, its preservation, sending out, etc., by a special committee.

III.—*Instructions to Public Vaccinators.*—A. *General.*

§ 1. In places where infectious diseases extensively prevail, such as scarlatina, measles, diphtheria, croup, whooping-cough, typhus (exanthematous), or erysipelas, public vaccinations are not to take place while the epidemic lasts. If the public vaccinator only first hears of such epidemic after beginning the vaccinations, or even if only individual cases of erysipelas arise, he must at once discontinue the vaccinations in that place, and report accordingly. If the public vaccinator is himself treating any cases of infectious disease, he must equally guard against their extension through his own person, in the exercise of his vaccination duties.

§ 2. In the announcements of public vaccinations, care is to be taken that the parents of the children receive printed instructions as to the public vaccinations, and as to the treatment of the vaccinated during the development of the pustules.

§ 3. The public vaccinator, with the assistance of the local police, will take care that the appointed place is not overcrowded, and is sufficiently ventilated. The presence together of subjects for primary vaccination and for revaccination must be most carefully avoided.

B. *Obtaining Lymph.*—1. *Human Lymph.*

§ 4. Until vaccination with animal lymph becomes general, vaccinators will obtain the necessary lymph to begin the vaccinations with from the vaccine institutions of their respective States. Lymph for continuing the vaccinations, or for disposal to other medical men, they must obtain for themselves from fit subjects.

§ 5. The child from whom lymph is to be taken must be examined over the entire body, and must be perfectly healthy and well nourished. It must be the child of parents who do not suffer from hereditary disease; and, in particular, the children of mothers who have aborted or have had premature deliveries must not be chosen. The child furnishing lymph should be at least six months old, born in wedlock, and not the first child of the parents. Only exceptionally may these rules be deviated from, if there is not the slightest doubt about the parents' health. The child must be free from ulcers, fissures, and eruptions of every kind, from condylomata on the vascular regions,—lips, arms, and navel,—from glandular swellings, from chronic affections of the nose, eyes, and ears, and must bear no signs of syphilis, scrofula, rickets, or any other constitutional disease.

§ 6. Lymph from revaccinated persons may only be used in cases of necessity, and never for primary vaccination. The health must be seen to, as above detailed.

§ 7. Every vaccinator must indicate the source and date of his lymph, especially when obtained by himself, or to be sent to others. The lymph itself is to be so labelled that no doubt can arise as to its source, and these indications must be preserved for one calendar year.

§ 8. Lymph must never be obtained from any child later than the day-week after vaccination. The vesicles supplying it must be ripe and uninjured, and their bases must be only slightly inflamed. Vesicles which have begun to be erysipelatous must in no case be used. At least two vesicles must be left untouched.

§ 9. The vesicles are to be opened either by punctures or small incisions; squeezing the vesicles, or pressing their neighbourhood to obtain more lymph, must not be done.

§ 10. Only such lymph may be used as exudes of itself, and which to the naked eye contains neither blood nor pus. Bad-smelling or very liquid lymph is to be avoided.

§ 11. Only the purest glycerine must be mixed with the lymph. The mixture must be effected by means of a clean glass rod.

2. *Animal Lymph.*

§ 12. As soon as animal lymph is brought into general use, the vaccinators will obtain all their lymph-supply from the State institutions.

§ 13. The above directions in § 7, § 10 (second part), and § 11 will apply here. Special instructions will be issued as to the obtaining of animal lymph.

C. *Preservation of Lymph.*

§ 14. Liquid lymph is to be kept in clean, hermetically-closed capillary tubes, or in glass vessels, holding from one to two cubic centimètres. Dry lymph may be kept on glass slips, or in glass vessels, or on ivory-, whalebone-, or horn-points. No articles used in preserving lymph should be used a second time, except after thorough cleaning and disinfection (best by boiling in water).

§ 15. Lymph should be protected from a freezing temperature, and from a heat of more than 50° C. (120° F.)

D. *Vaccination and Revaccination.*

§ 16. It is recommended not to vaccinate infants until they have passed the age of three months. Children suffering from severe acute or chronic diseases, much affecting their nutrition, should not be vaccinated, nor revaccinated. Exceptions are permitted (especially during epidemic small-pox), and these will be left to the judgment of the vaccinating surgeon.

§ 17. The instruments for vaccination must be clean, and before every fresh vaccination must be cleansed with water and dried. In drying them, handkerchiefs and the like must not be used, but carbolised or salicylised wool. No instruments should be employed which cannot be thoroughly cleaned. Instruments used in vaccination must not be used for any other purpose.

§ 18. The moistening of dry lymph is to be done with pure water or glycerine, or a mixture of these.

§ 19. As a rule, vaccination will be performed on the upper part of the arm. In primary vaccination, from three to five superficial incisions of at least one centimètre long, or as many superficial punctures, may suffice, on each arm; in revaccination, from five to eight superficial incisions, or punctures, on one arm. Much bleeding is to be avoided in vaccination. Lymph must not be applied with a brush.

§ 20. Primary vaccination may be considered successful if there are at least two well-developed vesicles. If there is only one such vesicle, auto-revaccination, or another vaccination, must be performed at once; but the vaccination certificate must be given all the same.

In revaccination, the formation of papules or small vesicles at the site of the operation, is enough for success.

E. *Private Vaccinations.*

§ 21. All the above directions are to be in force here also, except §§ 1, 2, 3, 4, relating to public vaccinations exclusively.

IV.—*Instructions to the Parents or Guardians of Children to be Vaccinated.*

§ 1. Children must not be brought to the place of vaccination from any house in which there is an infectious disease, such as scarlatina, measles, diphtheria, croup, whooping-cough, or small-pox.

§ 2. The children must be brought for vaccination with washed bodies, and in clean clothes.

§ 3. Also, after vaccination, it is most important to keep the child as clean as possible.

§ 4. If the child cannot have a daily bath, it should at least be washed daily.

§ 5. The child may be fed as usual.

§ 6. In favourable weather the child may go into the open air; but in midsummer, the hottest part of the day and the direct rays of the sun should be avoided.

§ 7. The vaccination-places should be preserved with the greatest care from being rubbed, scratched, or rendered dirty. The sleeves must be of such a size as not to irritate them.

§ 8. When the vaccination is successful, small vesicles begin to form after the fourth day, which, as a rule, increase up to the ninth day, the child being slightly feverish, and thus develop to elevated pocks, surrounded by an inflammatory zone. They contain a clear fluid, which begins to be turbid on the eighth day. From the tenth to the twelfth day the pocks begin to dry up and form scabs, which fall off of themselves after from three to four weeks. The removal of lymph for further vaccination is painless, and does the child no harm.

§ 9. In the regular course of the vaccination-pocks, no dressing is required; but if a marked and wide redness appears immediately around them, or if the pocks open of themselves, the arm is to be covered with a piece of linen soaked in olive oil, or still better, smeared with vaseline. If any considerable sickness set in after vaccination, a medical man is to be called in.

§ 10. The vaccinated children will appear at the place of vaccination on the appointed day for inspection. If the vaccination is successful, the parents will then receive a certificate to that effect, which is to be carefully preserved.

§ 11. If the child cannot be taken for inspection on account of illness, or the presence of infectious disease in the house, the parents must report the same to the public vaccinator, on the day of inspection at latest.

V.—*Instructions to Local Authorities regarding Public Vaccinations.*

§ 1. Public vaccinations are not to be held in any place where infectious diseases widely prevail, such as scarlatina, measles, diphtheria, croup, whooping-cough, exanthematous typhus, or erysipelas. Children shall not be brought for vaccination from any house in which any of the above diseases exist; moreover, adults belonging to such houses must keep away from the place of vaccination. The vaccination and inspection of children belonging to such houses must take place separately from other children. The same rule will apply when small-pox occurs in any house.

§ 2. For the public vaccination, rooms are to be provided sufficiently large, properly ventilated and cleaned, and capable of being warmed, which will allow, wherever possible, a separation of the waiting- from the operation-room. In cold weather the rooms are to be warmed.

§ 3. A representative of the local police will be present during public vaccinations, to assist in the preservation of order. Writing materials are to be provided. During revaccinations and the subsequent inspections, a teacher is to be present.

§ 4. Overcrowding of the rooms, especially of the operation-room, is to be avoided. The number of children directed to appear will be in proportion to the size of the rooms.

§ 5. The presence together of children for vaccination and children for inspection must be prevented. In every case children for primary vaccination must be kept as separate as possible from children for revaccination (school-children).

§ 6. It is to be seen that the children come to the places of vaccination washed and in clean clothes. Children unsatisfactory in this respect may be sent away from the place of vaccination.

VI.—*Conclusions as to securing a proper Selection of Public Vaccinators.*

1. Public vaccinators are to be appointed by the authorities of the province.

2. Public vaccination is to be preferably assigned to the district medical officers.

3. The official title, "Vaccinating Surgeon", will follow the assumption of the duties.

4. The remuneration of the "Vaccinating Surgeon" (public vaccinator) will require the sanction of the authorities of the Department.

VII.—*Conclusions as to the Technical Preparation of Surgeons for Vaccination.*

1. On this subject the following rules will be in force:—(*a*) The clinical instruction of students is to embrace instruction in vaccination. (*b*) Moreover, every surgeon who is about to vaccinate, either privately or publicly, must produce proof that he has attended two public vaccinations and two public revaccinations, and that he has acquired the necessary knowledge as to obtaining and procuring vaccine lymph.

2. In medical examinations, a knowledge of vaccination, both technical and general, is to be required.

VIII.—*Conclusions as to the Institution of a Permanent Technical Supervision, by Medical Officials, of Public Vaccination.*

1. The supervision of public vaccination will belong to the next superior of the Medical Officers of the Department (under the supposition that the public vaccinators themselves are for the most part medical officers).

2. This supervision will consist in an inspection of one or more public vaccinations at the appointed place and time.

3. Every public vaccinator must undergo an inspection at least every three years.

4. The technicalities of vaccination will form the chief subject of inspection; and next, the drawing up of the lists, the selection of the place for vaccination, the number of children, etc.

5. Private vaccinations are also to be subjected to examination, in so far as they are not done by the family doctor in the family.

6. A technical supervision of vaccination institutions—in particular, both public and private institutions for the supply of animal lymph—is also to be carried out by periodical inspections.

7. The attention of the vaccination authorities must also be extended to the trade in vaccine lymph.

IX.—*Conclusions respecting the framing of a Small-pox Statistic.*

1. Within eight days after every death from small-pox, a certificate is to be filled up by the Medical Officers appointed by the Departmental Authority, which certificate must contain the particulars indicated in the annexed form. To ensure the carrying out of this, a co-operation of the medical and non-medical officials of the affected district is recommended.

Within a further period, to be determined by the same Authority, the certificate is to be forwarded to the statistical centre of the State, or other appointed place, for collection, verification, and statistical compilation.

2. All the certificates for the previous year, up to March 1st, every year, are to be sent from the different States to the Imperial Health Officer. At the same time a summary is to be sent, giving the calculated population at the beginning of the year of those towns having 20,000 or more inhabitants, in age-classes of ten years, for each sex. In so far as no better data are available for this, the average yearly increase or decrease of the population, as yielded by the last census, may be taken for the years after the last census, both as regards the whole population, and the age-classes in each sex.

Form of Certificate for Cases of Small-pox.

Commonalty.....
Administrative district.....
State..... .....
Street..... No. (or indication) .....
Christian and surnames of deceased.....
Sex—Male—Female. (Underline the indicated sex.)
Day, month, and year of birth .....
Occupation. (In case the deceased did not gain his or her own living, or was not independent—*e.g.*, married women without special occupation; children, etc.—give the occupation of the head of the family.).....
.....
Remark whether deceased was regularly employed away from home in any factory or workshop, and if so, of what kind; or attended school .....
Day, month, and year of death .....
Place and date.....
Signature..... .....

The first eight conclusions formed the answers to eight queries propounded to the Commission. I will now take these in order; the remaining conclusions, except those on the adoption of calf-lymph, are of less interest.

Query 1: Does one attack of small-pox, when survived, confer protection against subsequent attacks?

Koch regarded it as almost superfluous to say that it was generally recognised that all acute infectious diseases conferred immunity against future attacks of the same disease. This protection was by no means an absolute one, *e.g.*, measles occasionally attacked the same individual even three times. But second attacks of small-pox were certainly rare. Bousquet had given 34 in 16,051 cases from 30 epidemics, while Siegel gave 26 out of 3,188 cases from the Leipsig epidemic

of 1871. Boeing's alleged relapses in Aachen, within a few weeks after the first attack, probably rested on diagnostic error. Reissner, out of more than 700 observed cases of small-pox since 1873, found only one case of a second attack, the patient stating that he had had small-pox forty years before. In the great epidemic, out of at least 12,000 cases in South Germany, no second attack had occurred. Reissner also pointed out the curious fact, that in former times all cases of second attacks had been stated as having occurred in children or young persons, never in adults: this pointed to error in diagnosis. Dr. Grossheim, of the War Office, out of 22,641 cases treated in the military hospitals of Germany during the war, had found hardly one alleged attack. One case certainly had excited great interest,—a man had a light form of variola three months after the first attack. Von Kerchensteiner, of Bavaria, had never heard of early second attacks; any such occurred only many years after the first attack. He himself had seen a *third* attack; Helva, of Vienna, had attended the patient in the first two attacks; he died in the third. Krieger had seen only one certain second attack out of 500 observed cases; two more were doubtful. Thierfelder had seen two second attacks of measles a fortnight after the first attacks, so that an *early* second attack of small-pox was theoretically possible; but he had never heard of nor seen one. Von Koch had met with only two second attacks in Stuttgart: both were fatal; in each case, the second attack after a long interval of time from the first. Siegel said that Wunderlich found 22 second attacks in 1,727 cases in Leipsig, 1871, and six of the 22 were fatal. One of these cases was given by Wunderlich, a reliable and exact observer, as the case of a person who had already had small-pox in the same epidemic. This was a positively observed case of an *early* second attack of small-pox; but the fact that one such case in medical literature excited such interest, showed that it was a very rare exception, and therefore proved the general rule, that small-pox confers immunity against itself.

Koch incidentally, in answer to Boeing's argument that the change of small-pox from a children's to an adult's disease in this century was owing to improved veterinary legislation and improved social condition, remarked that the anti-vaccinationists were very fond of assuming the identity of sheep-pox with small-pox. The two diseases had nothing to do with each other; their epidemics were never simultaneous, nor even quickly followed each other; further, he had always failed, in abundant experiments, to communicate small-pox to sheep by inoculation, or sheep-pox to man (viz., himself).

The chief members of the veterinary profession were all on his side. In answer to a mistaken notion of Weber's about the law on ovination, Koch explained that inoculation of man with small-pox was forbidden early in the century, but that ovination—inoculation of sheep with sheep-pox—was only forbidden a few years ago.

Query 2: Does vaccination confer a similar protection; and is the diminution of small-pox since the beginning of the century to be ascribed to the introduction of vaccination, or to other causes?

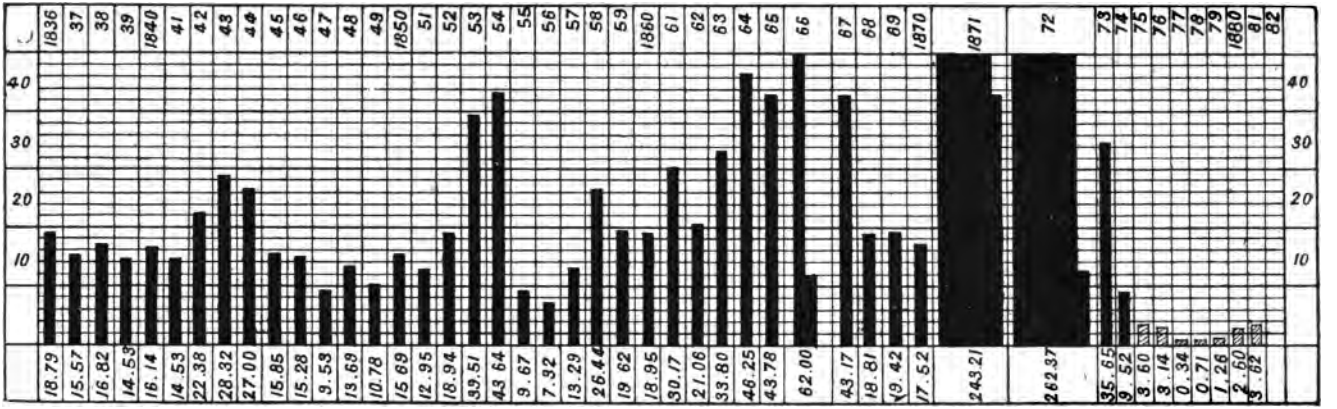
This query was the centre round which circled the chief interest of the debates; its discussion occupies eighty-four pages of the Report. Several statistical compilations were brought forward on this subject; those of the Board of Health I will give in full.

A.—*The Board of Health Statistics, showing the effect of compulsory revaccination in Germany since* 1874.

Dr. Koch explained that for these statistics he had taken the small-pox mortality as the only reliable basis to go upon, for the following reasons. To begin with, it was well known that the mortality from all diseases was much greater during infancy than in the years next succeeding it, and that all small-pox statistics ought to be arranged in age-classes, considering the great influence of age upon morbidity, lethality, and mortality. (By lethality is meant the degree of reaction of the organism towards an infectious disease.) Now, although some statistics in age-classes appear to show that vaccination is useless, this was only because the same statistics brought in the "vaccinated condition" of the patients. But all comparative statistics founded on this last were *ipso facto* unreliable, "usually worthless". Directly the question of the vaccination or non-vaccination arose, room was made for a number of errors; in fact, this was why the original returns of the epidemic were not produced. To begin with, the information as to whether anyone who had died of small-pox had been vaccinated or not, had been given by the deceased's friends, *and not* (in the majority of instances) *by medical men.* Again, such statistics did not state (1) whether the vaccination was successful or not; (2) the degree of success—the number of vesicles produced; (3) the date of the vaccination. This was most important, for they were all agreed that vaccination did not protect indefinitely; and it was a very different thing to him whether a man had been vaccinated five years previously, or fifty years previously.

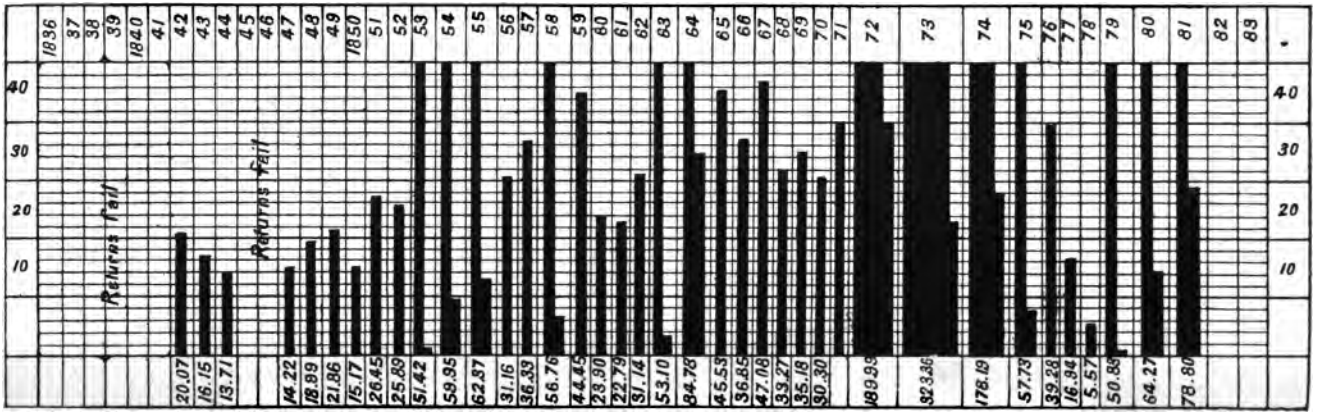
CHART I.—**PRUSSIA.**—*DEATHS FROM SMALL-POX PER 100,000 OF THE POPULATION.*

Compulsory Revaccination after 1874.



In 1882 the Death-rate was 3.64.

CHART II.—**AUSTRIA.**—*DEATHS FROM SMALL-POX PER 100,000 OF THE POPULATION.*



In 1871 the Death-rate was 39.28; in 1877, 53.18, *not* 16.94; in 1878, 60.59, *not* 5.57; in 1881, 82.67, *not* 78.80.

As to the patients' friends, they always leaned to an affirmative reply. But lastly, even if they had all this information accurately given, they would require to know, in order to satisfy the demands of such a statistic, besides the proportion of the vaccinated to the unvaccinated (at different ages) amongst those who died of small-pox, *the same proportion amongst the living population.* Now this knowledge it was impossible to obtain, and even if obtained for one day, it would not hold good for the next day, so shifting were the conditions as regards population.

The mortality from small-pox was the only secure basis; if this ever erred, it was on the side of excess. Von Scheel supported this by the examples of 1881 and 1882. The small-pox deaths returned to the Imperial Statistical Office were 1,473 in 1881, and 1,330 in 1882; but on verification, these numbers were reduced to 979 and 957—*i.e.*, 66 per cent. and 75 per cent. respectively. This excess was an error which told not against the Vaccination Law, but for it, because it was more appreciable in proportion to the much fewer deaths after the law than before it—*i.e.*, the true numbers would contrast still more strongly. The error was never the other way; no small-pox deaths were returned as due to other diseases.

Such being the case with regard to statistics, Koch argued that all the greater importance attached to *personal experience;* and this he relied upon to a great extent. He had seen much small-pox, and had vaccinated and revaccinated thousands, and had arrived at the profound conviction that vaccination did protect. His own personal experience might not be thought worth much, but when it was corroborated by the vast personal experience of experts at home in the subject, it became important. In other medical questions it was allowed its full weight, why not here?

Prussia. (*See Chart I.*)

First, the small-pox mortality of Prussia since 1874 is compared with that of Prussia before 1874 (when compulsory revaccination began). The deaths per 100,000 of population from 1816 to 1872 are as follows:—

1816–30=45, 27, 29, 20, 10, 17, 20, 19, 14, 15, 14, 25, 19, 19, 24.
1831–50=11, 30, 60, 48, 27, 18, 15, 16, 14, 16, 14, 22, 28, 27, 15, 15, 9, 13, 10, 15
1851–70=12, 18, 39, 43, 9, 7, 13, 26, 19, 18, 30, 21, 33, 46, 43, 62, 43, 18, 19, 17
1871–72=243 and 262, respectively. (The years of the great epidemic.)
1873–74=35, 9. A marked decline, as usual after epidemics.
1875–82=3.6, 3.1, 0.3, 0.7, 1.2, 2.9, 3.6, and 3.6.

Thus the small-pox mortality, after 1875, *sinks to and remains at lower figures than have ever been exhibited as far back as any records go.* (*The original goes back to* 1816.)

Austria. (*See Chart II.*)

Next, Prussia is compared with Austria, a similar country. The small-pox deaths per 100,000 population in Austria are as follows:—

1842–44=20, 16, 13.
1845–46. Data are wanting.
1847–60=14, 18, 21, 15, 26, 25, 51, 59, 62, 31, 36, 56, 44, 23.
1861–71=22, 31, 53, 84, 45, 36, 47, 33, 35, 30, 39.
1872–74=189, 323, 178. The epidemic.
1875–76=57 and 39. The usual decline.
1877–81=53, 60, 50, 64, and 82.

Now the Austrian epidemic was the severer of the two, and affected the susceptible portion of the population even more than in Prussia; and yet, after a decline of only two years, the mortality leaps to its usual figures, such as occurred before the epidemic, and even higher. Why this immense difference in the behaviour of the small-pox mortality after 1875? There were no changes in the veterinary legislation or the social conditions to account for it. *The only difference between the two countries is, that in Prussia revaccination was made compulsory in* 1874, and to this alone, therefore, can the difference be due.

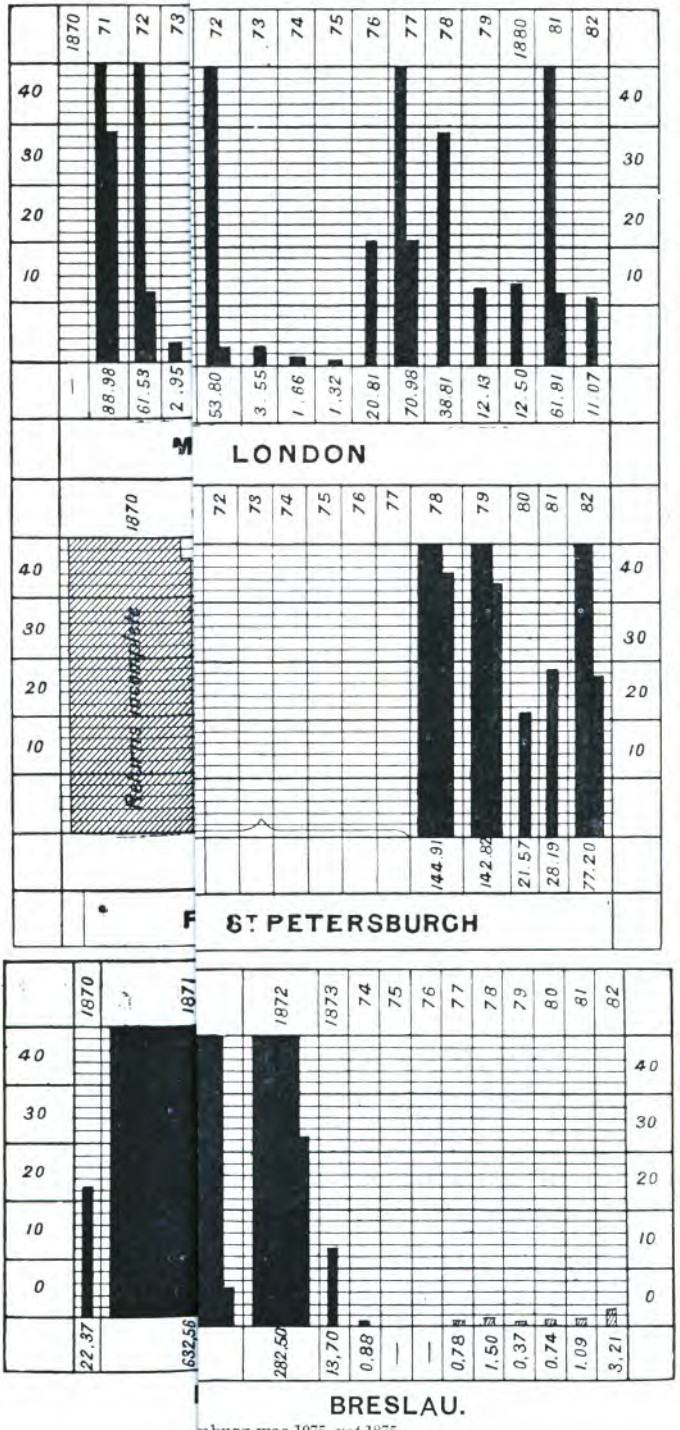
Cities, German and Foreign. (*Chart V.*)

Thirdly, five German cities are compared with five foreign cities before and after the introduction of compulsory revaccination in the former. In regard to this comparison, Boeing fought hard to maintain that it was unfair to compare Berlin with London, because London possessed very stringent compulsory vaccination. But Koch explained, to Boeing's own satisfaction at last, that by the term "compulsory vaccination" in the Tables was meant the compulsory vaccination ordained by the German law, and that is *a compulsion to vaccination and revaccination*—and this existed in no other country than Germany.

As is said in the text accompanying the following Table (see opposite page), "nothing can show the influence of the Vaccination Law better than the contrast between such cities as, *e.g.*, Berlin and London, or Dresden and Prague."

The Armies. (*Charts III and IV, p.* 42.)

Lastly, the German, or rather the Prussian army, is compared with the French and Austrian armies before and after 1874. I have added the British army. "Like the general populations of the different countries, the armies suffered severely from the great epidemic of small-pox in



mburg was 1075, *not* 1875.

1870, 1871, and 1872. Accurate numbers of the French loss from small-pox are wanting, but it is certain that this loss was very great.

Small-pox Deaths per 100,000 *Population in the Years* 1870–83.

						(Compulsory Revaccination since 1874.)								
	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
Berlin	22	632	138	11	2.4	5.1	1.8	0.4	0.7	0.7	0.8	4.7	0.4	0.3
Hamburg	25	1075	95	0.8	0.5	0.0	1.8	1.2	0.2	0.0	0.0	2.2	0.4	0.0
Breslau	13	356	282	13	0.8	0.0	0.0	0.7	1.5	0.3	0.7	1.1	3.2	8.3
Munich	0.0	88	61	2.9	1.0	0.0	0.5	0.0	0.9	0.0	0.0	10	2.9	0.0
Dresden	9.0	360	85	13	4.3	2.5	0.5	0.9	0.0	1.8	3.6	2.6	1.3	0.8
London	30	242	53	3.5	1.6	1.3	20	70	38	12	12	61	11	3.4
Paris	546 ?	?	5.5	0.9	2.4	13	20	6.8	4.4	45	108.	49	29	20
Vienna	46	74	536	228	135	113	167	84	75	46	73	123	108	9.6
Petersburg	*	*	*	*	*	*	*	*	144	142	21	28	77	46
Prague	?	15		?	30	11	78	395	86	84	290	64	57	224

* Returns wanting.

"The German army suffered by far less than the French from small-pox, although in France it came continually into

contact with a population amongst which small-pox was rife. The *war in itself*, with its fatigues and deprivations, could not have caused the great increase in small-pox, for the Austrian army suffered still more.

"The only difference as regards the small-pox relations of the three armies is this, that whereas the Austrian and French armies, as must be acknowledged, were scantily revaccinated, and were amongst a population scantily revaccinated, and hence more permeated by small-pox: the German army, on the other hand, enjoyed the advantage of a carefully carried-out revaccination, and the relative protection afforded by a surrounding community almost free from small-pox.

"The evil influence of a community affected with small-pox, and the relative protection afforded by a surrounding free from this disease, is at once evident from the number of small-pox *cases* in the German army. For it must be allowed that revaccination had already been practised in the army for several decades, with a fair degree of carefulness. In spite of this, the small-pox cases in 1867-69—*i.e.*, before the general revaccination law—are more numerous than after 1874. No other explanation can be afforded for this, than that just as during the war small-pox in the German army considerably increased, in consequence of its coming into contact with small-pox in France, so the same thing must have happened in Germany itself before the war, when there was more small-pox amongst the civil population than there has been of late years.

"It is worthy of note that not a single death from small-pox has occurred in the Prussian army since 1874, whereas both the Austrian and French armies still show considerable losses in this respect. No other reason can be made to account for this striking difference than the effect of a rigidly conducted vaccination and revaccination."

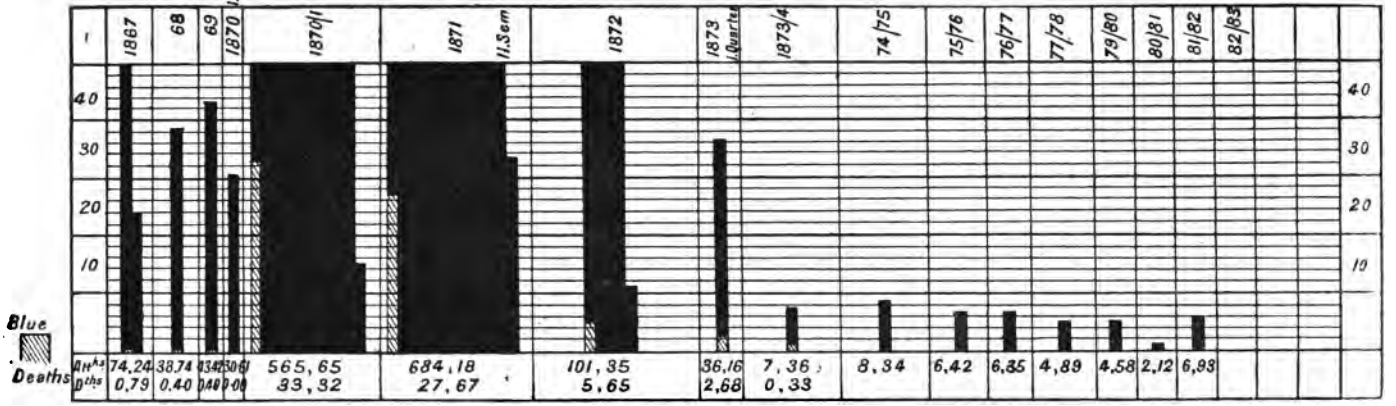
The text which accompanies the Imperial Board of Health Tables concludes in these words:

"In the above comparative Tables the principles of statistics have been rigidly adhered to. Collective populations are compared with collective populations, large cities with large cities, armies with armies. Moreover, the subjects of comparison are numerically so vast, that the errors which inevitably attend smaller figures are eliminated.

"The result most conclusively testifies to the beneficial effect of compulsory vaccination (*i.e.*, the German compulsory revaccination—*vide supra*, page 40).

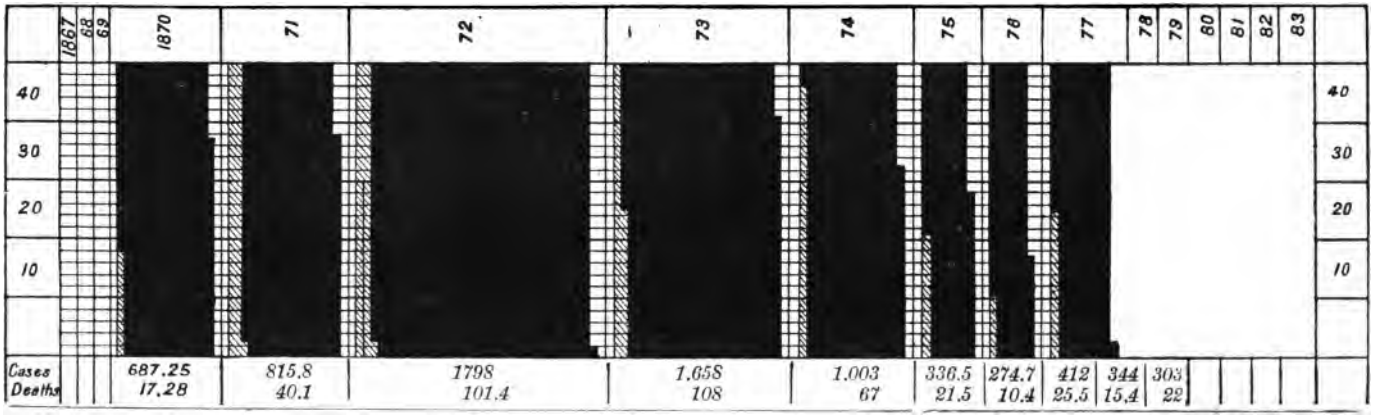
"In *Germany as a whole*, small-pox has diminished to a

CHART III.—**PRUSSIAN ARMY.**—*SMALL-POX CASES AND DEATHS PER 100,000.*



In 1872 the Attacks were 161.35, *not* 101.35.

CHART IV.—**AUSTRIAN ARMY.**—*SMALL-POX CASES AND DEATHS PER 100,000.*



Prussian (or German) Army.—Small-pox Cases and Deaths per 100,000 *Men.*

	1867.	1868.	1869.	1870. (1st half.)	1870-1.	1871. (2nd half.)	1872.	1873. (1st quarter.)	1873-4.	1874-5.	1875-6.	1876-7.	1877-8.	1878-9.	1879-80.	1880-1.	1881-2.	1882-3.
Cases	74	38	43	30	565	684	161	36	7.3	8.3	6.4	6.3	4.8	4.5	2.1	6.9	4.5	2.2
Deaths	0.8	0.4	0.4	0.0	33	27	5.6	2.6	0.3	—	—	—	—	—	—	—	—	—

Austrian, French, and British Armies.

	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.
AUSTRIAN ARMY.																
Cases	?	?	?	687	815	1798	1658	1003	336	274	412	344	303	—	—	—
Deaths	?	?	?	17	40	101	108	67	21	10	25	15	22	—	—	—
FRENCH ARMY.																
Cases	231	633	372	?	?	60	27	39	141	230	222	213	115	153	111	—
Deaths	18	42	22	?	?	10	4	3	17	28	19	20	8.9	15	8	—
BRITISH ARMY.																
Cases	62	88	107	42	192	111	58	34	12	26	41	48	23	12	22	36
Deaths	3	2	11	6	23	17	8	5	2	1	3	8	2	2	2	3

degree never before known, so far back as any records reach. In all neighbouring countries small-pox is, as usual, still very prevalent.

"The *German large cities* suffer scarcely at all from small-pox, which continues to demand its victims in all large foreign cities.

"Lastly, the *German army* is almost free from small-pox, while other armies still suffer severely."

B.—*The Bavarian Statistics.*

Von Kerchensteiner said that the presence of French prisoners had caused much small-pox. The statistics went back to 1803; Kolb himself was on their statistical commission. They had had very little small-pox, except during the war, when the number of cases (for 1871) was 30,742; of deaths, 4,748. Of the cases, 29,429 were vaccinated (95 per cent.). The proportion of cases to the population was only 0.68 per cent.; in former times it had been even 10 per cent. For the year 1872, he had age-classes by him. *The mortality amongst the revaccinated was* **5** *per cent., amongst the vaccinated (once)* **14** *per cent., and amongst the unvaccinated* **45** *per cent.* Of these last, at least seven-eighths were children under one year. Dr. Boeing argued that, assuming Klinger's estimate correct—viz., that 96 per cent. of the population were vaccinated—that left 200,000 unvaccinated, with only 47 cases amongst them, if only they left out all the children under one year; for amongst them the mortality was naturally very high, and most of them were unvaccinated. 790 unvaccinated cases died, and 734 of them were under one year. On the whole, the mortality for 1871 was 60 per cent. in the unvaccinated, 30 per cent. in the vaccinated, and 8 per cent. in the revaccinated. In reply, both Koch and Von Kerchensteiner fully allowed the influence of age; but they showed that the proportion of unvaccinated population was much less than 4 per cent., and that it would be more correct to take it at ½ per cent., but it could not be accurately given; so that, even deducting those under one year, the deaths amongst the unvaccinated would still be far higher than amongst the vaccinated.

As to there being so many cases in such a well-vaccinated country as Bavaria, this was the very reason why they had introduced compulsory revaccination. It was seen that primary vaccination was quite insufficient, although it had been most carefully carried out in Bavaria.

C.—*Dr. Siegel's Leipsig Statistics.*

An intense epidemic raged in and about Leipsig in 1870, 1871, and 1872. About 8 per cent. of the people had small-pox, and over 1 in 1,000 died. There had been an anti-vaccination agitation for some years before, so that in Leipsig they decreased from 3,400 vaccinations in 1868, to 1,300 in 1870; while in the villages round, before 1867 almost all the children were vaccinated, but in 1867 and 1868 only 60 to 70 per cent., in 1869 only 30 per cent., and in 1870 only 15 per cent. were vaccinated. (!) Then came the epidemic, and out of 200,000 people, 2,500 died.

When the epidemic was beginning, Dr. Siegel requested all the medical men to send him accurate returns of the cases every fortnight. The result was as follows, all the cases being *medically observed* and reported. There were, in all, 3,881 cases, with 721 deaths. Of these cases, 1,600 were children under 15, and amongst these 1,600,

1,350 were unvaccinated, with 488 deaths = 36 per cent.;
250 were vaccinated, with only 8 deaths = 3.2 per cent.

Of these eight, six were reported as having been successfully vaccinated; the other two were doubtful cases. The work had been arranged in age-classes, with analogous results.

It had been called a poor result, that 250 vaccinated children should have small-pox, and that eight should die; but, then, the severity of the cases should be taken into consideration. The 250 cases were mostly extremely slight, as indeed the mortality showed; and the notes proved that many of the patients were hardly a day or two days in bed, and that the slightest varioloids were included.

On the other hand, the heavy mortality of 488 amongst 1,350 unvaccinated—*i.e.*, nearly 40 per cent.—indicated a severe course of the disease in the vast majority of the cases.

D.—*Dr. Grossheim's Army Statistics (Prussia).*

A. Before the war of 1870-71.

Rigid vaccination of every recruit was begun in 1834, and the small-pox deaths at once diminished. Before that date the deaths were as high as 108 in 1831, and the same number in 1833, while the lowest number was 12 in 1825; but from 1834 to 1869, the highest number in any year was 9; and the army small-pox mortality was also less than the civil.

B. Since the war.

"No army can show such a good result. . . . . Compare

our deaths, viz., *two*, in ten years of peace, with the deaths in the French army in 1872 to 1880, viz., 588—more than all the cases in the Prussian army during the same ten years (376) . . . . The French cases are 5,586, giving a yearly average of 621. . . . . As to the Austrians, in one year (1878) they had 1,114 cases and 50 deaths, ... though no epidemic then occurred."

c. During the war.

The number of cases in the whole field army was 4,991, with only 297 deaths, a mortality of not quite six per cent. The vaccinated condition could not be given for all the cases, but it could be given in 1,005 cases, with 61 deaths. Of these 1,005 there were—

Unvaccinated.....	= 4 cases,	with 1 death.	Mortality—	25
Successfully revaccinated ...	=109 „	„ 2 deaths.	„	... 1.8
Unsuccessfully revaccinated ...	=224 „	„ 10 „	„	... 4.5
Not revaccinated.....	=531 „	„ 46 „	„	... 8.6
Revaccinated (result unknown)	=130 „	„ 1 „	„	... 0.7
Revaccinated (result doubtful)	= 7 „	„ 0 „	„	... —

They had hardly any small-pox in the army when they first went into France. Most of the cases occurred amongst contingents (especially the Saxony and Hesse) among whom revaccination had only recently been introduced (1868 and 1869, respectively). The Bavarian troops also suffered heavily from small-pox, partly because they were more exposed to it than the rest, and partly because their heavy losses in battle had to be made up by substitutes not so well revaccinated. In fact, the Bavarian War Minister issued an order that the fresh troops should all be revaccinated. Compare now the French prisoners in Germany with the immobilised army there:—French prisoners, 372,918; small-pox cases, 14,178; deaths, 1,963 (over 13 per cent.). Immob. army, 300,424; small-pox cases, 3,472; deaths, 162 (4.6 per cent.). As to the French field-army, the number of small-pox cases had been estimated as 23,469; but this number he could not verify. But in the Paris army alone, of 170,000 men there were 11,500 cases and 1,600 deaths.

Vaccination in the French army was very imperfectly done; and even in the years 1866-9, the small-pox deaths per 100,000 were 46, 17, 169, and 95. When they learnt from proper sources that only 59 per cent. of the French children were vaccinated; that the army surgeons repeatedly complained of the scanty vaccination even before the war; that several general orders were issued on the subject; that vaccination was not imperatively performed on every recruit, as in the German army, but only on those who had not had

small-pox already, or had not been previously vaccinated, they might be sure that the French army (including prisoners) was not under the same vaccination protection as the German army. Anthony had put down the successful army vaccinations in 1876-1880 at 50, 33, 59, 69, and 71 per cent. This was far behind the German vaccination, which in 1880 showed 106,264 successful vaccinations out of 122,000. Again, in 1869, there were 115,876 French recruits, while there were only 54,720 vaccinations that year, and the successes of these were only 34.25 per cent. The German successful vaccinations during the war were 70 per cent., though this was far behind their usual proportion. They were very short of lymph, and there was often no time for the necessary care and inspection.

The sanitary conditions had been said to be much worse, and the depressing influences greater, in the French army than in the German. But, apart from the fact that the Austrian army suffered so much in the same epidemic, if this were true, the French would have had more typhus and dysentery than the Germans, whereas it was otherwise. Small-pox was the least fatal of all the acute diseases in the German army. Out of 475,400 patients of the whole field-army, the cases from typhus were 154 per 1,000; dysentery, 81; ague, 14; and small-pox, 10. But in the Paris army, out of 77,231 deaths, 8,068 (or 104 per 1,000) were due to small-pox; 4,821 (or 62 per 1,000), to typhus; and 1,042 (or 13 per 1,000), to dysentery. Although deaths were here compared with cases, this was enough to prove his assertion.

Comparing the German army with the civil population of same age in Berlin, the deaths per 10,000 in the latter were 20, in the former only 2.4. (!)

Koch added that the Langres garrison, near which he was himself attached to a lazaretto for two months, was only locked up for a few weeks, yet in seven months out, of 15,000 men, it lost 334 by small-pox (22 per cent.), while the Metz garrison, out of ten times the number of men, lost only 176 (11 per cent.). Now, the Metz troops belonged to the regular army, and were better vaccinated than the Langres troops, which consisted of "gardes mobiles" and "gardes nationales."

Having now finished with the most important of the statistics, I will say a word on the law of 1874. It is said by the anti-vaccinationists that Prussia had compulsory revaccination already long before 1874. This is not true, as I will show by two quotations on the subject, one from Dr. Boeing

(an opponent of compulsory vaccination), the other from Dr. Koch. Dr. Boeing says, on page 39 of the Report: "Before 1874 we had no Vaccination Law in Prussia . . . . . therefore the influence of *revaccination, which we have first from* 1875. . . . ."

Dr. Koch says, on p. 46: "The same thing is seen when we compare the mortality statistics of one and the same country—*e.g.*, Prussia—before and after the introduction of compulsory vaccination by the Vaccination Law of 1874." And again, on p. 34: "The object of the Tables is to illustrate the effect of the Vaccination Law of 1874; and I may presuppose that with every reader, when compulsory vaccination is spoken of, that compulsion is to be understood which is prescribed by that German vaccination law—that is, the compulsion to vaccination and revaccination."

So much for Prussia. As regards Bavaria, Von Kerchensteiner says (p. 95): "It has been said that in Bavaria, in spite of vaccination—I mean by this simple vaccination up to the year 1874, from thence onwards vaccination in Herr Geheimrath Koch's sense of the word....."

It is true that a few isolated towns or even districts may already have had revaccination; indeed, I find that in the Jaxt district in South Germany the school children had been revaccinated just before leaving school, for thirty years previously. But the revaccinated people formed an infinitesimal portion of the population before 1875.

Query 2: What is the duration of the protection afforded by vaccination?

On this subject the Commission agreed that it was impossible to fix an exact duration for everyone, but some definite period had to be given, for the sake of legislative enactments. They were almost unanimous that vaccination should be repeated soon after early childhood; and the age of ten years was chosen, as giving time for repetition of vaccination, if required, before the children left school. Koch's own opinion was, that in about half the population, protection had already ceased in about ten years after primary vaccination. In Posen, he had had about 50 per cent. of successful revaccinations in children aged ten years; but some people were undoubtedly protected for life by revaccination. He himself was an instance, so far.

Eless had pointed out that the protective influence of vaccination against small-pox often outlasted the insusceptibility to revaccination. People had been successfully vaccinated even after small-pox itself, just as small-pox occasionally attacked the same individual a second time.

It is interesting to read that here Koch rejoiced to find that both Drs. Boeing and Weber acknowledged a certain degree of immunity from small-pox after vaccination, though this was inconsistent with their voting in the two previous conclusions. Boeing replied that he was a public vaccinator himself, and not an "anti-vaccinator", and he had never denied a certain degree of protection after vaccination. Dr. Weber's immunity was in reality a tolerance, like the arsenic eater's. This was easily shown to be a misplaced analogy; the arsenic-eater did not confine himself to one heroic dose of arsenic, nor was the vaccine virus imparted in minute doses. Dr. Betz radically opposed vaccination on etiological grounds.

Query 4: What relation subsists between vaccination-protection and the number of vesicles?

Dr. Koch enumerated the Stockwell Hospital statistics, showing in patients with no vaccination-marks the mortality was nearly 50 per cent., while the presence of even one good cicatrix lowered it to 5 per cent. With four or more marks, the mortality was only 1 per cent. The investigations of Oppert of Hamburg, supported this. Eulenburg thought that three vesicles should be the minimum, at a good distance from each other. Kranz had some figures to show. In München, 1,000 children aged twelve had been revaccinated alike, with six punctures on each arm. The success depended on the number of primary cicatrices. Of those with one cicatrix, 278 were successfully revaccinated; with two, 200; with three, 252; with four, 82; with more, 68, 65, and 38; with twelve, 31. Thus there was a lowering from 278 to 31, inversely, according to the number of primary cicatrices. Burchardt had examined 10,436 men in the army. Of these, with no cicatrix, 76.7 were successfully revaccinated; with between one and ten marks, 70.3 per cent.; with ten, 63.8 per cent. He did not think the number made much difference. In the army, revaccination was still called successful if one vesicle developed. Koch moved for at least two vesicles as the minimum of success, for there might be a doubt about one alone. Feiler had found that children with only one mark could be revaccinated at six years of age, but that with three or four marks, nearly every revaccination failed. Siegel inclined to three. On the other hand, Jenner and the first vaccinators were satisfied with one good vesicle, and proved perfect protection after it, at least for a time, by unsuccessful inoculation of small-pox virus. Reissner, after revaccinating 6,000 children, had found the number of cicatrices make a distinct difference in the successfulness. Eulenburg thought that the organism was much more sus-

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ceptible to vaccination than to variola. As to what should be done when only one vesicle had developed, he would say, perform auto-revaccination on the seventh day from that vesicle. In Holland this was done regularly, if less than ten vesicles were present. Siegel supported this, and had done so since 1880, in Leipsig. Von Koch's motion for a general expression that the protection increased with the number of vesicles, was lost by 8 votes against 5, and Dr. Koch's motion for two vesicles as the minimum was carried by 12 against 3.

Query 5: At what age is revaccination necessary?

This question involved no discussion, after the debate on the third question.

Query 6: Does the vaccinated condition of the community increase the relative protection against small-pox, which the individual has acquired by vaccination; and is vaccination thus beneficial not only of individual but general use?

Koch explained that the protection afforded after vaccination and revaccination was by no means absolute, and, according to their experience, an absolute protection of the population would never be attained. Hence the importance to the individual of keeping his surrounding as free as possible from small-pox. The strongest support for this view was found in the army tables; for the law of 1874 made no difference in the vaccination of the army, and yet small-pox had remarkably declined directly afterwards. Moreover, their charts showed them that small-pox in Germany now only infested the frontiers, especially the Austrian frontier, where small-pox was still very prevalent. It was therefore the right and the duty of the State to require all its citizens to be vaccinated, that the partial protection of the individual might be supplemented by a general protection. It was said by some, "Let those who like be revaccinated, but do not compel everybody." This was not just. It would only be just to argue thus if the individual acquired absolute protection by vaccination. As to isolation of small-pox patients as an alternative measure, he would ask whether such isolation as would be required to vanquish an epidemic would not be a compulsory measure a hundred-fold and a thousand-fold more an infraction of the personal liberty of the people, and would not cause a thousand-fold more resistance, than the incomparably milder measure of compulsory vaccination and revaccination in childhood? But even the most rigid isolation would not keep the disease away from them; and Siegel pointed out that it would necessarily be always too late. Regarding disinfection of patients and their belongings,

it was condemned as both impracticable and useless. The conclusion was voted by 12 against 1; 2 abstaining.

Query 7: Is vaccination attended by danger to the health? Of what kind is this danger (if any), and what is its extent?

This gave rise to a most interesting discussion. Koch's original motion ran thus—"Under certain circumstances, vaccination is attended with danger." This he withdrew at first in favour of Thierfelder's—"Under special circumstances", etc. Von Kerchensteiner preferred Koch's motion as being more general—we could not as yet accurately define the special circumstances. Koch's motion was then reinstated. Vaccination, Koch allowed, was essentially a disease, but not practically such. Grossheim said that no dyscrasiæ had attended the army vaccinations. In 1882, returns were asked for from all the army surgeons; and these returns showed that out of 1,200,000 revaccinations, decided indispositions occurred after only 78, and one man had died (of "blood-poisoning"). Thus, only six out of every 100,000 were sick, if they assumed the returns to go back ten years; but many went back much further. Granted that the temperature usually rose, after vaccination, on the fifth, sixth, or seventh day, sometimes to 40° C. (104° F.), this was, as a rule, for only a few hours; and there were whole series of cases with lower temperatures. But to call vaccination "a disease" would simply mislead the public. They would require to fix first the pathological signification of the word "disease"—a toothache, or an ingrowing toe-nail, was a disease, properly speaking. Probably no one in Berlin at that moment was ideally healthy. The medical was different from the popular acceptation of the word. Boeing desired that vaccination should be called a disease in all cases. Eventually the Commission resolved that vaccination in itself was not attended with danger; at the most, there was only a temporary febrile condition, and any danger was due to accidental complications. No one voted against this conclusion.

Then came the next part of the question—Of what kind and extent is the danger?

Syphilis (said Koch) came first, as the best known, though it did not deserve to stand in the foreground. He was not aware that any death after vaccination had ever been established as being due to transferred syphilis; in the isolated cases that occurred it was a curable disease, that generally was cured. The exact number of transferences he could not give. Quite a number of cases had been recorded that had been found to be erroneous on investigation; perhaps others, really syphilitic, had not come to their knowledge. He thought

it would suffice to say that syphilis had been transferred by vaccination, that the number of cases was extremely small, and that the danger might be entirely avoided by the use of animal lymph. Practically speaking, the only other danger was *erysipelas;* any cases of "*blood-poisoning*" were primarily erysipelatous. As to any other diseases, all they could say was, that other diseases might possibly be imparted; *e.g.*, there was the theoretical possibility that tuberculosis might be transferred, though no such case had ever yet been established. Vague expressions as to *scrofula* were often used, by anti-vaccinators especially; but they all knew that the incubation-stage was here so long that it would be quite impossible to establish its connection with vaccination. There existed abundant opportunities for children to be infected by the virus of so extensive a disease as tuberculosis (if liable to it?—E.J.E.). No other diseases needed any mention. As to vaccination-erysipelas, there was an "early" and a "late" erysipelas. The former alone was due to the lymph itself. They had now learnt to experiment with the micro-organism causing it, and how to avoid the disease by proper treatment of the lymph. Only syphilis and erysipelas therefore needed mention in their answer. Bad wounds might be made by bad treatment of the vesicles, and all sorts of things were applied by the parents. Hence sometimes, ulcers, eczema, lymphatic gland swellings, etc. Eulenburg said, that as to the Oedt epidemic of small-pox itself after vaccination, Professor Strohl, of Strasburg, had clearly shown that the affected children were already infected by small-pox, and were vaccinated in its incubation-stage. Von Kerchensteiner declared that the "*post hoc, ergo propter hoc*" argument was never so outrageously applied as by anti-vaccinators. The Commission agreed that as yet we only know of syphilis and "early erysipelas" as being transferable, but it was thought best to use the wider expression, "accidental wound-diseases", instead of the latter. The conclusion was thus voted by 12 votes, 3 abstaining, and no one voting against it.

Query 8: Have any particular diseases, or has the general mortality, increased since the introduction of vaccination?

Some diseases, especially scrofula, had been said to have increased since vaccination was introduced, but neither medical literature nor individual experience gave any warrant for this. Boeing agreed with Koch, but desired to insert the words "scientifically provable". Weber also acknowledged that Vogt's statistics from England had not the desired scientific evidence, though they had been sufficient to draw attention to the subject. The well-known English

Parliamentary Return was brought forward by him, showing an increase of skin-diseases, scrofula and syphilis, in periods corresponding with the sharpening of the Vaccination Law, while the general mortality had declined. Weber laid weight on the increase of scrofula, but confessed that as to syphilis the causes of its increase were too numerous to allow of any particular conclusion being drawn. This was very mild opposition from two opponents of compulsory vaccination. Reissner accounted for the alleged increase by, in the first place, the cultivation of the statistical sense of late years amongst the profession; and secondly, by a more physiological tendency than formerly. Thierfelder pointed out that, since so many more lives were saved by vaccination, there was more scope for the attacks of general diseases. He could not see any connection between vaccination and the alleged increase of syphilis; and as to scrofula, a connection could only be assumed upon suppositions no longer tenable. He did not attach much importance to the English table. Grossheim said that their minute army statistics gave no support to the idea of any increase of disease as a result of vaccination. Returns from 1873 to 1882 showed a steady decrease of all diseases, as also of the general mortality and the inabilities to serve in the army. Krieger relied on a statistic from Alsace-Lorraine, reaching from 1564 to 1877 (see vol. x of *Statistical Reports of Alsace-Lorraine*), which showed a decided reduction of mortality on the introduction of vaccination. The births had not increased, but the deaths had decreased. Eulenburg referred to Swedish statistics from 1715 to 1795, and again, after the introduction of vaccination, from 1825 to 1840 and thence to 1850—the deaths being given for every five years of life. A decline of mortality was shown in each period after vaccination began, except in the period from one to five years of age, when the mortality was stationary. Krieger showed that the average yearly mortality in Strasburg had sunk from 37 per 1,000 last century, to between 32 and 33 in the present century. Koch's very open answer was then voted, as modified by Boeing. This ended the first series of conclusions.

In regard to the second series, "On the Introduction of Animal Lymph", an interesting memorandum on the subject had been drawn up in the Imperial Board of Health Office for the use of the Commission, and this summed up succinctly the advantages and disadvantages of human and animal lymph respectively. The substance of this has already been given to a great extent in Koch's remarks on the dangers attending vaccination. It was shown that there never could

be any danger of transferring syphilis with calf-lymph, even if the calf had been vaccinated with syphilitic lymph, because the syphilitic virus could not exist outside the human body for longer than a very short time, certainly not above a day or two. (Human lymph, preserved in tubes or on points, must, therefore, be equally safe, in my opinion.) The Commission were reminded, moreover, that all human lymph contains blood, even the clearest lymph, as might be seen by examining a drop under the microscope. As to "perlsucht" (or bovine tuberculosis), nothing was rarer in young calves; even the intra-uterine "perlsucht" was extremely rare.

The advantages of human lymph were:—certainty of effect; simpler operation; costlessness.

The disadvantages of human lymph were:—the proved danger of syphilis and erysipelas; the possibility of tuberculosis; and the difficulty of obtaining enough, in epidemic periods especially.

The advantages of calf-lymph were:—security against syphilis; security against "early erysipelas" by antiseptic methods; advantages of vast supply, viz., uniformity of quality and easy subjection to test-inoculation; great simplification of vaccinator's work.

The disadvantages of calf-lymph were:—somewhat less certainty of effect; a rather more complicated operation required with it; much greater cost.

It was estimated that every vaccination would cost one-twentieth of a shilling; but as every vaccination already cost one shilling, this did not make much difference. Arnsperger, Von Koch, and Von Kerchensteiner, all thought that the methods of preserving animal lymph were not yet sufficiently perfect, and desired the Commission to express a preference for calf-lymph, without using any obligatory terms. But Koch pleaded for his motion, which he said was not to be taken to mean that only animal lymph was to be used henceforth,—as, indeed, the next resolution would show. Grossheim said the army could not do without human lymph during wars and epidemics.

Pfeiffer was quoted (one of the highest authorities on the subject), as saying that he decidedly preferred calf-lymph to human. But Pfeiffer had only just published the following: "The true cow-pox virus, the retro-vaccine virus (calf-lymph, after vaccination of calves with human lymph), and human vaccine lymph, are all equivalent in certainty of effect, course, and protective power. But animal lymph quite excluded syphilis, which, however, was equally excluded in human lymph also by the exercise of ordinary care.

Accordingly, no essential preference can be bestowed on animal lymph."

Again, Freund, of Breslau, (1879) had collected all the known cases of transferences of syphilis,—viz., 52 reported transferences and 510 reported cases of infection—out of many millions of vaccinations. He concluded that in 25 of the transferences they could easily have been avoided, while in 17 more the data for forming an opinion on this point were not forthcoming.

It appears that calf-lymph is already largely used in Germany, in some places exclusively, as the maps which I produce show. In 1882 the following vaccinations took place —the lymph is specified:—

Population (1880) = 45,234,061.

A.—PRIMARY VACCINATIONS.—Number for vaccination, after deductions, 1,338,464. Of these, vaccinated successfully, 1,158,696 (86.5 per cent.); unsuccessfully, 31,441 (2.3 per cent.); result unknown, 5,773.

Origin of Lymph.—Number vaccinated with human lymph, 1,103,462 (91.4 per cent.); calf-lymph, 91,941 (76.4 per cent.); arm-to-arm, 532,242; uncertain, 11,834.

B. — REVACCINATIONS. — Number for revaccination, after deductions, 1,068,830. Of these, revaccinated successfully, 898,601 (84 per cent.); unsuccessfully, 119,972 (11.2 per cent.); result unknown, 6,147.

Origin of Lymph.— Number revaccinated with human lymph, 954,915 (93 per cent.); calf-lymph, 66,514 (6.5 per cent.); uncertain, 3,291.

Successful primary vaccinations, 95.9 per cent. Successful revaccinations, 87.7 per cent.

Von Conta moved, that neither lymph deserves special preference. Boeing moved for the words, "at least as regards syphilis," in place of the words, "syphilis, erysipelas, etc." Boeing and Reissner strongly desired calf-lymph. Koch moved to insert the words, "so far as a direct transference of syphilis is concerned". Arnsperger moved to the effect that the substitution of calf-lymph was "to be striven after." Von Kerchensteiner moved, "that vaccination with calf-lymph *can* replace the use of human lymph"—(Koch's expression was, "has to replace"). Boeing withdrew his motion on Koch's insertion of the word "direct". Thierfelder's motion ran like Koch's, but left out the words in parenthesis, and substituted "will be avoided" (for "*can*, etc."). Von Kerchensteiner withdrew his in favour of Grossheim's, "the substitution . . . . is recommended." Upon voting, Von Conta's motion was rejected by 13 against 2:

Thierfelder's, by 12 against 1, 2 abstaining; and Koch's motion was accepted by 11 against 2, 2 abstaining.

Ninth Series (a national small-pox statistic).—Several members of the Commission begged for a sickness- as well as a death-statistic, but Koch argued strongly against it, for reasons which I have anticipated on a previous page (38). The Imperial statistic of small-pox required a basis as absolutely secure as could be got, and even a mortality statistic required careful verification. The separate States were at liberty to make their own sickness-statistics. Boeing's motion for the latter also was therefore rejected by 11 against 5, and Koch's was accepted without voting.

In the discussion on the yearly returns of the population, divided into age-classes of ten years for each sex, Boeing begged for the separate insertion of the age-class below one year; but Von Scheel, of the Statistical Department, explained that any lower division than ten years would leave more room for error, and would materially assist in making verification difficult. Eventually, Boeing's motion was only lost by eight against eight—which seems to be a pity, considering the importance of the influence of age in this subject.

In conclusion, I must observe that a truly scientific spirit seems to have animated the Commission as a body. In the first place, the "vaccinated condition" was rejected as being too unreliable for statistics, though it might be useful (Dr. Koch said) on subsidiary points, and if only thoroughly and absolutely reliable, would be the most valuable basis of a small-pox statistic. Again, the statistics given, especially those of the Imperial Board of Health, rest on good bases. Half-a-dozen towns are not separated from all the rest, and compared with isolated portions of the general population. And lastly, the subject of any attendant dangers of vaccination was discussed exhaustively, and yet most temperately; and here the German opponents of compulsory vaccination deserve credit. They did not pull out from the National Statistics any special disease which may happen to have increased during the last forty years, and rashly assert its connection, or even bring it into juxtaposition, with vaccination—as if I were to argue that vaccination causes diarrhœa, because I find in the Registrar-General's Return that diarrhœa has increased considerably since the introduction of vaccination. I commend these points to the consideration of the opponents of compulsory vaccination in this country.

By the kindness of Prof. Koch, I have just learnt that the small-pox deaths per 100,000 in Berlin in 1883, were 0.33; in 1884, 1.6; in Prussia in 1883, 1.9; in Bavaria in 1883, 0.6; in 1884, 0.15.

DIPHTHERIA AS A CHRONIC MALADY IN PARTICULAR INDIVIDUALS, WITH LIABILITY IN THEM TO RECRUDESCENCE.

By D. ASTLEY GRESSWELL, B.A.,B.M.,Oxon.

(*Read: Feb. 10th,* 1886.)

Mr. President and Gentlemen,—I purpose to consider in this paper certain facts which appear to show that diphtheria in certain individuals may become a chronic disease, and from time to time enter upon an active and infectious phase. Diphtheria, chronic and recrudescent, is not, I believe, admitted to exist; and it is because I have been led to think that diphtheria in these phases does exist, and that in these phases it may play an important part in maintaining the malady in a community, that I venture to address you this evening on this subject.

I have lately been engaged, on behalf of the Local Government Board, in prosecuting inquiries into diphtheria, in various parts of the country; and in the course of these inquiries I have met with a considerable number of persons who, having been affected with diphtheria years ago, have suffered almost constantly ever since from throat-affection. I have been told by persons who have suffered in this way that their throats have been habitually and peculiarly sensitive to changes of weather, very trifling exposure to wet or cold having sufficed to produce in them acute inflammation of the tonsils. Further, diphtheria has occurred among persons associating with those who at the time have been suffering from this condition; and in instances where I have not been able to find satisfactory explanation for this diphtheria, I have had to ask myself whether the condition, here referred to, may be of a diphtheritic nature. The question, put shortly, stands thus. Is the chronic tonsillar inflammation which is left in particular persons after an attack of diphtheria, due to continued sojourn in them of the material cause of diphtheria? And do the violent reactions of the tonsils of these persons to weather changes involve likelihood of rendering them diphtheritically infectious?

I proceed to set out certain facts not inconsistent with such belief.

1. A lad, R. G., twelve years of age, fell ill of diphtheria in July, 1883. There is clear evidence that he had associated but a few days previously with a diphtheritic patient. His father, his mother, and the three others (children) of the family all fell ill of diphtheria in quick succession after him. Two of the children, aged respectively fourteen and twelve years, have suffered ever since from tonsillar trouble, and the tonsils of each have, ever since, been prone to swell largely on exposure to either cold or wet.

Late in April, 1885, a woman who had visited this family fell ill of diphtheria. I took some considerable trouble in attempting to solve the origin of her case; and the only fact that I felt worthy of consideration was that she had associated frequently, for some weeks prior to her attack, with the family referred to. She had, I learnt, become much attached to the children aged fourteen and twelve years.

The conclusion suggested itself to me that the woman contracted diphtheria, either from some member of this family, or from some infected thing in the house inhabited by this family.

The latter alternative is open; it would appear to be impossible to exclude it. But I would suggest—and I think with equal, or rather, with greater, probability of truth—that she derived infection from one or other of the children. Six days prior to her attack, I had seen these children. The child aged fourteen years at that time presented a strawberry tongue, an enlarged left tonsil, and hypertrophied pharyngeal follicles; a white, sticky substance also was adherent to various parts of the throat. The child aged twelve years had at the same date large red tonsils; the follicles were widely open, and a white substance was exuding from them. If the view which I have taken of the origin of infection in this case be correct, a person once infected with diphtheria may remain capable of transmitting infection for a period of nearly two years.

2. A girl, A. P., took diphtheria in December, 1881. This girl has, I am told, suffered ever since from sore-throat. Whenever she has been exposed to cold, especially if the feet have been wet, her tonsils have very quickly swelled, and to an extent involving, her mother has supposed, danger of suffocation. She suffered from one such attack of sore-throat in July 1883, very shortly (two weeks or so) after she had taken on duties as monitress in a school. I was not able to find any other explanation for this attack of sore-throat than the one suggested by herself and her mother;

she "had taken cold"; there was not apparent any evidence to show that she had within a recent period been in association with any person, or been in contact with any thing, infected with diphtheria.

This girl continued her duties at school for a day or two after falling ill, and within a few days—at the most, five or six—three children who were attending the school fell ill, and two of the three died, of diphtheria; while other cases and deaths occurred evidently as result of infection contracted from the three children referred to. I made searching inquiry into the previous health of the school children and school teachers, also of the persons living in the village and in the surrounding country; but I was not able to find evidence affording any probability that the three children derived their infection from any other source than the teacher, A. P.

This case suggested to me dormancy and recrudescence in an infectious form of the material cause of diphtheria in the individual.

3. A lad, J. W., nine years of age, suffered, it is said, from diphtheria late in 1877, and all the rest of the family (four in number) suffered about the same time. In 1878 he again, it is said, had diphtheria, and one of his brothers died of diphtheria. He was then two years of age. Ever since this second attack he has been subject to severe attacks of sore-throat, and "when he gets wet-shod, the tonsils quickly swell and become covered with a white coating". One morning in August, 1884, he played truant from school; he returned to school (where he boarded) late, the same night, very wet and feeling ill, and next day he was reported by his medical attendant to be suffering from diphtheria. It is possible that while truant he came into contact, or that previously he had been in contact, with diphtheria-infected persons or things. But, though I took considerable trouble to trace the movements of the boy, I was not able to discover such contact; and the consideration arose as to whether mere exposure to wet had been in this lad a sufficient cause for revival of growth of the material cause of diphtheria lying dormant in him. The question may be raised whether the last attack was truly one of diphtheria. All I can say in answer is, that the medical attendant who pronounced the case to be one of diphtheria had had considerable experience of this malady; and that I have suspicion that the lad has been on several occasions, in late years, a centre for diphtheritic infection.

I quite recently met with a very similar instance in the person of a girl.

4. A family, twelve in all, with governess and four servants, living together in an isolated house, were remarkably free from illness, and no case of sore-throat, croup, laryngitis, diphtheria, mumps, or scarlet-fever can be remembered to have occurred in the house for some consecutive years prior to March, 1881. Between March, 1881, and July, 1882, seven cases of diphtheria occurred among the inmates of this house.

There is good reason for thinking that diphtheria was in the first instance imported in the person of a servant girl, and that all of the seven cases above spoken of were due to infection derived directly or indirectly from her.

Most of the patients were sent away, either very shortly after their several illnesses had been recognised, or as soon as possible during convalescence; and attack in all but two instances was preceded by the return, a few days or a week or so before, of the person who had suffered last.

It may be noted that the first patient was, in the early days of her illness, said to be suffering from quinsy, and that her death, which took place six days after she had fallen ill, was registered as due to diphtheria. It may also be added that diphtheria occurred and caused deaths in several families among which these patients and convalescents had been sent.

General and careful cleansing and disinfection were conducted in and about the house on several occasions during the above-mentioned period.

Still, however, severe attacks of sore-throat continued to occur, and cases of diphtheria were recognised, viz., one in February, 1883, one in July, 1883, one in September, 1884, three in quick succession in October, 1884, one in May, 1885, and finally, the last case in June, 1885. All but one of these were primary attacks. It is quite possible that the belongings of the house had, by virtue of the succession of cases between March, 1881, and July, 1882, become so far infected that fresh occurrences of sore-throat and diphtheria may be explained on this ground. But I wish to draw attention to the fact that one of the seven who suffered between March, 1881, and July, 1882, has suffered from throat-affection ever since, and has had acute attacks of sore-throat from time to time. On one occasion, when she was suffering from an attack which she regarded as an excessive development of her ordinary attacks, she was recognised on medical authority as again suffering from diphtheria; and, ten days after this illness began, a servant, a new-comer, slept with her, and a few days later fell ill of diphtheria.

5. A girl, E. D., aged 15 years, another monitress, was

taken with diphtheria early in June, 1884, and her illness is definitely traceable to personal infection. Among the children at the school where she was teaching there occurred three cases of diphtheria in November of the same year. I was able to suggest but one explanation for these cases. This explanation lay in the fact that the monitress had a second severe attack of sore-throat early in November, when she was a second time disabled for a few days from work, and that she returned to school, still with some degree of tonsillar discomfort, only a few days before these three cases occurred. I was not able to trace any renewal of infection as a cause of her second illness.

The five groups of cases above detailed serve to illustrate what I have in view when speaking of diphtheria in certain individuals as a chronic malady with liability in them to recrudescence. To these illustrations I would add yet another.

In an asylum, in which some 150 female orphans are brought up as domestic servants, throat-affections of one and another sort (variously spoken of as putrid-throat, sore-throat, throat-affection, strumous throat, and the like) have almost constantly been present, and diphtheria has been recognised from time to time for several years past. On turning to the fragmentary records of illness in this asylum (the sick-register in which are entered only those patients actually under treatment on twenty-six days in the year—a fortnightly record, in fact)—I found the following facts recorded. A girl, then 11 years of age, was taken with diphtheria on February 23rd, 1881, and she was suffering from loss of ocular accommodation on April 8th of the same year. This girl has suffered frequently from sore-throat since this attack, and on October 7th, 1883, she and four other orphans were invalided with "sore-throat and catarrh". The precise order in which she and the other four fell ill cannot now be ascertained. Again, one of the four referred to has suffered on and off from sore-throat ever since October, 1883, to an extent, indeed, necessitating periodic removal to hospital, and quite recently she has been recognised as suffering from diphtheria. Other similar facts were recorded, suggesting a chain-like order of succession among cases of sore-throat and diphtheria.

It is, I think, at least open to question whether diphtheria has not been maintained in this asylum in the persons of its inmates, and in a way as suggested by the facts just mentioned.

In turning now to the bearings which diphtheria, chronic and recrudescent, may have upon sustained prevalence of the disease

in a community, I feel that little need be said; for, if we admit that diphtheria may in certain persons become a chronic affection, and at times re-enter upon an active phase, we admit a factor of evident importance in the causation of sustained prevalence of diphtheria.

In the course of my inquiries I have met with several persons who, while suffering from what I have spoken of as recrudescent diphtheria, have, apparently, been the starting-point for fresh infection of a large number of persons hitherto healthy, for a fresh outbreak, in fact, of the disease in a community. Acute attacks of tonsillitis sequent upon an attack of diphtheria—or, as I have supposed, attacks of recrudescent diphtheria—in monitresses have, on several occasions, appeared to be the starting-point of diphtheria among school children. Since I first thought of such interpretation for long-continued prevalence of diphtheria in a community, I have examined most, or all, of the throats of the children attending certain schools in times of epidemic prevalence of diphtheria; and I have on some of these occasions met with children who, some months after having been supposed to be convalescent from diphtheria, have at the time of my examination presented creamy patches on the tonsils and pharynx. In this connection, I may add that I have lately had my attention drawn to several patients who, after an attack of diphtheria, have been discharged from hospital with "healthy-looking tonsils", but who have returned with genuine diphtheritic patches on the throat a month or so later. It is possible that such cases are due to renewed infection; on the other hand, they may be regarded as resulting from a renewed vitality of the virus still lying there.

The facts set out above afford the chief of the inductive evidence I have at command on this subject. There is, too, some weight of deductive evidence; and I would the more readily direct attention to it, because these views have been attacked on the ground that analogy does not furnish any warrant for their truth. Syphilis is a disease which we recognise in its chronic and recrudescent phases in instances in which we have almost complete certainty that there has not been any renewed inoculation. Ague manifests a like character in its widely separated relapses—relapses absolutely independent, it is said, of fresh exposure to malaria. The relapses of relapsing fever are supposed to be due to varying phases in the life-history of the parasitic organism believed to be its cause. Glanders in the horse may become a chronic affection, and from time to time take on an active and contagious character; glanders, indeed, may, to all appearance,

have been cured, and yet manifest itself afresh months afterwards, independently of any renewed infection. Scarlet-fever may relapse, presenting all the associated phenomena of the primary attack, very early in its convalescent stage; and though I personally know of no instance in which it would be possible to exclude fresh infection as the cause of the relapse, renewed vitality of the virus in the system suggests itself to me as affording a possible interpretation. The relapses of enteric fever are frequently put down to renewed infection; it is likely enough that in this case also relapse depends upon some phase of the history of a living cause. In this connection, also, the relation of gleet to gonorrhœa appears to be of significance. The contagiousness of gleet is, I believe, generally admitted. It has, however, been so precisely formulated by Dr. Emil Noeggerath, as the result of prolonged and careful observation, that I have thought well to record a statement of his. It runs thus. "Der latente Tripper bei dem Manne, wie bei der Frau, vermag bei einem bisher gesunden Individuum entweder eine latente gonorrhœ oder die Erscheinungen des akuten Trippers hervorzurufen." Contagious ophthalmia is a case of like kind.

In thinking of the meaning of recrudescence of maladies referable to the vital activities of a parasitic organism, the following considerations may, perhaps, be borne in mind.

It has, in recent times, been abundantly shown that protoplasm low in the scale of life, equally with protoplasm high in the scale of life, protoplasm undifferentiated equally with protoplasm differentiated, is so constituted that periods of rest are conducive to its well-being, nay, are necessary conditions to the continuance of its individuality. Among the Cryptogamia and Protista, periods of rest are of such long duration that the term "rejuvenescence" has been applied to the phenomenon of an apparently renewed vitality. But this phenomenon is not confined to the organic individual. It is well known that a crystal which doubly refracts light elongates in the direction of the optic axis, and contracts in the direction at right angles to this axis when it is subjected to the influence of heat, and that after one contraction thus brought about a period of rest must elapse before the crystal will yield to the same stimulus a second response equal to the first. It is most likely that these periods of rest are largely occupied by processes of a physical nature. Muscle we know to consist largely of doubly refracting particles. May not the period of rest, essential to muscle, be essential, as in the case of the crystal, largely for physical reasons?

It may be, also, that protoplasm in its native, its undifferen-

tiated state, consists of molecules, individually as definite in shape as inorganic molecules, and that its vital activities are the sensitive response of its molecules to the wave-movements in its environment, while its periods of rest are essential largely in order that it may slowly rearrange its parts. At any rate it seems clear that the organic individual, low or high in the scale of life, needs periods of rest; and the same, too, holds, it seems, of the inorganic individual. It seems to be justifiable analogy to regard recrudescence of a disease which is apparently referable to the life of a parasitic organism as the expression of rejuvenescence of that organism. That some such process takes place in some diseases is scarcely to be doubted; that it takes place in diphtheria I have more than suspected.*

I cannot bring this paper to a close without making reference to the conditions under which those persons have been living who have manifested recurring and, as I have thought, diphtheria-imparting sore-throat after having once suffered from diphtheria. The conditions have been almost without exception such as would unhesitatingly be pronounced unwholesome. The dwellings inhabited by these persons have been badly ventilated, damp and mouldy; and in some instances they have had grave defects of drainage. I have been told that such conditions are amply sufficient for the maintenance, if not for the production, of the material cause of diphtheria; and that, the conditions being as represented, there is no need to go further afield and speak of recrudescence of diphtheria in the individual. It may be so; but I think by no means necessarily so. The conditions referred to produce in particular individuals, it seems, a reduced vitality, which is largely evidenced in inco-ordinated aimless development of amœboid elements in adenoid tissue. The tonsils, with other parts of body, suffer, and it is likely enough that in such condition they afford exceptionally suitable "hosts" for sustained maintenance of the virus of diphtheria, and under certain conditions, such as those spoken of as "chilling", for a revival of it.

I would add, by way of conclusion, that if diphtheria presents such features as I have spoken of in this paper, there is additional reason for ensuring that dwelling-houses be made wholesome; and, too, there is need of special help at the hands of the therapeutist.

* It may be that protoplasm of even complex organisms may become so altered in its beat as to have a specific spermatic influence on protoplasm of the same or of other organisms. Gonorrhœa and contagious ophthalmia, in some of their manifestations, appear, indeed, to offer justification for such a speculation.

ON ASIATIC CHOLERA IN OUR FLEETS AND SHIPS.

By SIR WILLIAM SMART, M.D., K.C.B., K.I.H.,
Honorary Physician to Her Majesty.

(*Read: March 10th*, 1886.)

Mr. President and Gentlemen,—The aim of this paper is to collate what is known of cholera on the ocean, or at least so far as it has been experienced in the Royal Navy, which has been the principal field for observation. But as the disease has always been drawn from the land into ships, it may be unavoidable to refer thereto as we go on.

The Portuguese founded Goa in 1510, having captured its fine harbours from the Arabs, and soon after that they became acquainted with the disease as the *mordeshi;* and it is said that in 1540 they suffered an epidemic, and another in the eighteenth century, which caused the abandonment of the ancient city, and the building of another on the present site. The Dutch founded their city of Batavia in 1619, on the marshy site of an old mercantile town called Jacatra, and it continues to be the most unhealthy town in the East Indies.

In 1629 Bontius described this disease as he saw it there. As in modern times it has been conveyed to Java by ships from India, it must have been so then,—unless we say it was indigenous then, although it does not appear to be so now.

A hundred and twenty years then passed before it was again heard of, and that was in 1756, when Admiral Watson's squadron took Clive's army to avenge the treacherous brutality of the Black Hole at Calcutta. Mr. Ives, surgeon of the flag-ship *Kent*, wrote an interesting account of the voyage, in which he states that they arrived in the Hooghly terribly weakened by the scurvy, during convalescence from which, after a fortnight, several were attacked with spasms of the intestines, which suddenly carried off several men. Some who were thus attacked "recovered, but others remained in the most exquisite torture for twenty-four hours, and then expired." In this brief notice there is enough to convince of its having been cholera, although Mr. Ives looked on it as a coincidence of the scurvy.

His intimate friend, Dr. James Lind, in the third edition of his *Essay on the Diseases incidental to Europeans in Hot Countries*, refers to this case, at page 542: "Their recovery was slow, and while they had been feasted on the most excellent productions, several were suddenly seized with severe pains in their bowels, accompanied with a vomiting and purging, and with violent contractions of the legs, thighs, and arms, of which they died in a few hours." These particulars must have been obtained by Dr. Lind from his friend Mr. Ives, probably at a meeting like this to-night, at the Naval Medical Society, promoted by them at Gosport, for the communication of scientific knowledge.

It would appear that Mr. Ives must have had under treatment several cases of mort-de-chien, or cholera, without recognising their true nosological position. The earliest accurate observer of this disease among naval medical officers was Mr. Curtis, surgeon of H.M.S. *Seahorse*, and the Madras Naval Hospital in 1782-3. He became familiar with the disease then known among the Europeans in India as mort-de-chien, a French corruption of *mordeshi*, when it was raging epidemically along the Coromandel coast, by seeing it at Trincomalee, on board ship, and in the Madras Naval Hospital. His description of the attack and course of the disease is interesting, as showing what was thought of it then.

Mr. Curtis stated that "the most striking and alarming symptom is the great and sudden prostration of the powers concerned in carrying on the circulation, and maintaining the vital functions, without being the effect of great depletion or 'exhausted excitement', as the Brunonians speak", meaning thereby the stage of collapse. Of the evacuations he wrote: "They are, from the first, a thin, watery mucus in trifling quantity. Little, or nothing, is ejected by any retchings that happen; and it is observable from the very first, before the system has suffered much from the stimulus of pain, or the severity of the spasm. It attacked some of the men, remarkably robust, powerful, and muscular, who had been, immediately before, in perfect health." From which it may be inferred that he did not dwell on the discharges as pathognomonic, as we now are used to. In India there was one feature so prominent, and so new to him, that he preferred its name, *The Cramps*, as the most appropriate for the disease itself, connecting with it the stage of collapse. We recognise varieties in epidemics in different localities or periods in the predominance of the diarrhœal or the collapsed symptoms, the one signifying the milder, and the latter the severer type of the same disease, as dependent on the strength of the

virus, or the influence of the predisposing or the exciting causations, or the surrounding conditions. With regard to the importance of these in developing an epidemic, Dr. Hirsch (New Syden. Soc., vol. for 1883) says: "In cholera, the exterior influences are a *conditio sine qua non* to an epidemic. A person sick of typhus, small-pox, or measles, may become, under circumstances, a centre whence disease may radiate; but a cholera-patient, or any other object charged with cholera-poison, will not become a centre of disease." The truth of this is well exemplified in the history of ships, of which I can adduce several in which, after the introduction of a case, or of cases, that proved fatal, there has been no morbific result in a case of collapse among the proper crew. The predominance of cramps and collapse were marked features in the disease witnessed by Mr. Curtis, and beyond this he records a sequence in the rise and growth of tetanus to an epidemic. He records: "In the year 1782 no cases of it occurred in Madras Hospital, either after amputation or from any other cause. In the beginning of 1783 he had two patients seized by it,—one after amputation of a leg, the other from a gangrenous ulcer on a great-toe; amputation was performed, and the man died. In July, and early in August 1783, on the return of the fleet after an action off Cuddalore, the hospital-list was increased to 1,800 patients, and the accommodation was much crowded. Several of the ships, but newly arrived from England, and the fleet, had been out on a long cruise. Many of the people were thus in a sickly state, or tainted with scurvy. The land winds were still blowing, at their usual season, and there was no other known circumstance to which we could impute the surprising prevalence of tetanus which took place on this occasion, when there were from forty to fifty cases among the wounded, and only one of these recovered, and it was one of trismus only." This was an epidemic of tetanus, subsequent to one of cholera, and from it the question arises of correlation of causation.

Interlacing with these circumstances or events, another happened later, in 1782 (October), on the arrival from England of a land force, under command of Sir John Burgoyne, when the cholera had nearly subsided around Madras. As this expedition had gone the long voyage, it can be safely assumed to have been in a scorbutic state, for it could not then have been otherwise.

Mr. Girdlestone, surgeon of H.M. 101st Regiment, published, in 1787, his work, *On the Spasmodic Affections in India*, in which he relates his observations, from which I now quote:

"Spasms were the first disease that appeared amongst the troops who arrived at Madras in October 1782, under the command of Sir John Burgoyne. More than fifty of these fresh men were killed by them within the first three days after they landed; and, in less than a month from that time, upwards of a thousand had suffered from attacks of these complaints. The symptoms which commonly first presented themselves were coldness of the surface of the body, especially of the hands, feebleness of the pulse, and spasmodic contractions of the lower extremities, soon extending to the muscles of the abdomen, diaphragm, and ribs.

"As the spasm advanced, the muscles might be seen to assume the rigidity of cartilages, sometimes causing the body to remain immovably extended, sometimes bending the trunk through its whole length anteriorly, and sometimes, though seldom, backwards.

"The parts in which the spasm began generally remained rigid, but those which were subsequently seized with them had momentary intermissions of the contractions—the only interval of relief experienced by the patient from the most tormenting pains. The hands and feet then became sodden with cold-sweats, the nails livid, the pulse more feeble and frequent, and the breath so condensed as to be both seen and felt, issuing as a cold stream, at a considerable distance. The thirst was insatiable, the tongue whitish, but never dry; vomitings became almost incessant; the spasms, cold-sweats, and thirst increased with the vomitings, which last, if not checked, soon terminated the existence of the patient.

"In this manner, most commonly, was the succession of the phenomena, but often they were so rapid in their attack, that they seemed to seize the patient all in conjunction instantaneously.

"Some died in the first hour of attack, others lived a day or two with remissions, when they died either of universal spasms, or an apoplexy.

"*Autopsy.*—No injury found in the brain, liver, gall-bladder, stomach, or heart. All who recovered had very languid secretions for a considerable time, and frequently carbuncles, which would sometimes yield neither to bark, opium, nor wine."

While considering the disease he saw to be essentially spasms, Dr. Girdlestone dissociated, however, these tetanic spasms from cholera in these words: "As to giving opium in a solid form, *either in this or in cholera morbus*, anyone must see the impropriety of it, who considers how unfit the stomach in such cases is to perform any part of its natural functions."

He considered the chill night-air, when lying on the ground damped with dew, as the general exciting cause; many patients were soldiers who got intoxicated overnight, and in the morning, in order to freshen themselves to appear on parade, they were in the habit of drinking three or four pints of cold water, after which the symptoms quickly set in. Another cause given by him was the absence of the chili-pod from their diet, as a stimulating condiment to which they were not yet accustomed. The diarrhœal symptoms were certainly considered secondary to those of the nervous system. I am disposed to regard the cholera as Mr. Girdlestone observed it, to have been that phase of the disease with predominance of its spasmodic symptoms, in which the first impression of the causations had fallen, with extreme force, on the organic nervous system, and the reflex system of the spinal cord, increasing the cramps to a degree approaching the convulsions in tetanus: the suddenness of the accession, together with the rapidity of course, representing the extreme virulence of the poison received by its victims. In the same epidemic, Mr. Curtis had previously witnessed, from Trincomalee to Madras, a much milder type of cholera; and it was remarkable that he should have had to contend with a severe epidemic of tetanus on the same spot or locality in the following year.

If, in 1782, Mr. Curtis saw cholera in its milder or normal degree, and Mr. Girdlestone saw it with more violent spasmodic action predominating, fatal before vomiting and purging, or eliminative stage had commenced, yet even this was not the most terrible of its phases. It has been known to attack and end with so great rapidity that incubation of a germ is scarcely imaginable. Mr. Simon (see *Lectures on Pathology*, p. 271) states: "When the cholera reached Muscat, in Arabia (says Dr. Williams), in some instances only ten minutes elapsed from the first seizure before life was extinct; and in Pandaspore, in Lahore, the disease is said to have raged with such severity that 350 persons died in the streets, 'tumbling over each other lifeless', or, according to another authority, 'as if knocked down dead by lightning'." Such facts as these should not be forgotten in dwelling on the epidemics in which spasms have predominated.

Mr. Curtis had adopted, in India, the views of Dr. Paisley and other pathologists there, of its being the same disease as was described by Sydenham under the name of "Cholera Morbus", as epidemic in London in 1669, of which he said, that it was as different from the common summer cholera "as far as the poles are asunder" (*M. O.*, sect. IV, chap. i).

Mr. Curtis states (p. 52): "Since returning to Europe, I have had occasion to see many cases of the disease called in India 'Mort-de-Chien', similar in all respects to those we had at Trincomalee, only that they were much milder, and attended with less collapse of the 'vires naturæ'. The spasms were exactly of the same kind, but confined to the feet, legs, and thighs. All of them happened in the summer season, or in the autumn, and none of them proved fatal except one case."

Although minor accounts of outbreaks of the disease were given within the next thirty years, yet these appeared to have attracted no attention in Southern Hindostan; so that probably there was no great epidemic till that which began in 1817, at the city of Jessore, on an island in the delta of the Ganges, which awoke great interest among the Medical Boards of the three Presidencies, and gave origin not only to their official reports, but to many others by private authorities, which still guide public opinion. Through the agency of ships it spread to the island of Ceylon, Sumatra, Java, and the Philippines, the Mauritius and Bourbon, to Muscat in Arabia, and to Bussorah at the head of the Persian Gulf, by the year 1821. In the winter of 1823-24 it died out in Astrakan, and in 1830 it was brought there by the Caspian Sea in an infected vessel. In 1831 it crossed in ships to England, and in 1832 to Canada and the United States; in 1833 to Cuba, by the same mode of conveyance, in ships. It was not seen in S. E. America till 1855, when it appeared at Buenos Ayres, Rio Janeiro, and Para, in ships.

If we were in possession of the history of ships by which these transportations were effected, there might be found very much of interest concerning the laws that govern the growth and the extent and the severity of epidemics of Asiatic cholera. Strangely, Australia, having great intercourse with India, the home of cholera, has hitherto escaped.

Our medical records were not compiled previous to 1830, because the department had no autonomy, and no chief till then; or much might have been found relating to the vessels of war and hospitals on the East India stations, where, doubtless, from time to time, some were infected, the reports of whose surgeons were, possibly, as interesting as that of Mr. Curtis.

When cholera has been epidemic at home, as in 1831-32, 1848-49, 1853-54, and 1865-66, our seaports have, usually, been badly infected, and consequently the seamen stationed there have suffered in common with the inhabitants. On foreign service this differs; for, except when at war, ships have the power to avoid, or to leave, infected localities, with-

out intercourse with which Asiatic cholera has never yet been known to arise in a British ship of war.

In the first pandemic, when Lisbon was infected in 1833, our ships in the Tagus, and others of the squadron, suffered in Santander and other localities on the north-west coast of Spain. In the same year it was present in the West Indies, and was contracted at the Havana by one of our ships. In 1834 it appeared in the flag-ship *President*, from which it disappeared on her removal to three miles from the shore at Halifax, Nova Scotia.

In 1835 there was reported from H.M.S. *Caledonia*, at Malta, a small visitation of five cases, with one death; but as the island and nearest countries were then uninfected, it was disregarded, and the earliest official notice of it there was of the epidemic in 1837, that arose contiguous to the quarantine harbour, in which there lay several infected ships adjacent to the place of outburst.

Since 1830, epidemics of Asiatic cholera have amplified into pandemics in their extent, and I think that the medical history of the Royal Navy may be said to have some cases of that character, in proportion to its extent, in certain of its events. These I have attempted to collate, hoping to secure the interest in them of this Society, as a centre for discussion of all things relating to epidemiological science, now of increasing value to mankind. Therefore I ask its indulgence while listening to what I conceive to be but a feeble attempt to master a subject worthier of an abler pen.

The events I shall refer to are as follows: first, the epidemic of 1850, in the squadron at Malta; secondly, that of 1854, in the great fleets engaged in the war with Russia, in the Black Sea and the Baltic; thirdly, a peculiarly complicated epidemic in the boats of H.M.S. *Euryalus*, in China, in 1862, in which cholera, dysentery, and malarial remitting fever were intimately associated.

Epidemic in Squadron at Malta in 1850.—On the 10th of May the squadron under Sir William Parker, Bart., arrived at Malta from the Piræus, with all the crew in the most perfect state of health. The cholera was then in Tunis, from which refugees had, for some time, been hurrying to Malta. It was talked of that suspicious cases had occurred in the low-caste surroundings of the harbours, wherein those refugees were received. The crews of our ships were allowed their liberty on shore, as if the health-conditions were sound; and so they were, officially, for the health officers of the island had not pronounced adversely. Before the end of May all the crews were affected more or less

with diarrhœa, and the medical officers talked of some epidemic impending. I was an assistant surgeon in the *Queen*.

On the night of the 15th June, after the ships had been at anchor five weeks, two cases of Asiatic cholera were reported from the *Caledonia*, which recovered. On the night of the 18th, a fatal case on the *Queen;* on the 20th a case was taken from the shore to the *Superb*, in collapse, and quickly died. On the 26th there was, in each, a fatal case in the *Superb*, *Bellerophon*, and *Ceylon*. On the 1st July the *Caledonia* had her first fatal case after the fifth case of recovery. On the 2nd of July the *Ganges* had her first case, and it was fatal. On the 4th, the *Powerful*, after a day at sea, had two cases, her first, both proving fatal. Thus within sixteen days the whole of the squadron, except the *Terrible* and *Scourge*, had shown fatal results. All had undergone the same exposure to the causations of cholera during the growth of an epidemic, and yet there was a difference in degree of susceptibility, or in the process of incubation, in the several ships' crews, so that the first fatal cases among them were spread over sixteen days, and in others there was barrenness of fatal results. At midsummer the weather was hot, dry, and hazy, and the condition of the tideless harbour was aptly comparable to a huge cesspool, constantly receiving the excreta from the densely populated city and its surroundings, together with those from large barracks, and from eight thousand men afloat. Everything seemed conducive to epidemicity through the summer, and the civil authorities were totally inert, taking no measures of prevention until urged on them by those of the navy. It was generally stated that between the 14th and 30th of June there were forty-three cases, with thirty deaths, among the civil population of the lowest order. On the 3rd of July the infected squadron left the port, and on the 6th it bore away to the south-east coast of Sicily, with excellent results, returning off Malta on the 14th; and, keeping within a radius of twenty-five miles at noon, it cruised for thirty-six days, up to the 19th of August.

An incident of note occurred in the *Queen*, in July. She had twelve cases in her last five days in harbour, and three on the day of leaving it; and on the fourth, fifth, and sixth days at sea there was no case of cholera, but there were twelve of diarrhœa; and on the seventh to the tenth day cholera reappeared in five cases, when within the "aura" of Malta, where the disease was then strong.

Between the 23rd of July and the 16th of August the ships went into the harbour in turn, staying two days, to take on

board stores and water for a longer cruise. The *Bellerophon* was the first in, from the 23rd to 26th of July; the *Superb*, 26th to 28th; *Ganges*, 28th to 30th; *Caledonia*, 30th to 1st of August; *Hogue*, 1st to 3rd; *Powerful*, 5th to 8th; the *Queen*, 14th to 16th of August; and, of these seven ships, four were free from evil results beyond diarrhœa, and three had cases of cholera. First, the *Superb* had a fatal case on the 31st; second, the *Caledonia* had six attacks with two deaths; and third, the *Queen* had two fatal cases—the whole of which were due to remaining forty-eight hours in an infected port; and in all three it commenced on the third day after leaving it. The deaths in the *Superb* and *Queen* took place on the same days with the attacks, and there were not any subsequent cases, which was the more remarkable, inasmuch as the initial cases were intense ones. In the *Caledonia* there was a succession of cases on the 4th, 10th, 14th, and 23rd of August, when at sea, showing that there was at the time a higher degree of susceptibility among her crew, and proving that the virus of cholera was not extinct between the 1st and 23rd of August. Were all these cases simultaneously poisoned while in harbour, incubating respectively from one to twenty-three days; or were they propagated from the first to the second, and so on? As this question is important on the duration of epidemics, as well as on their method of development, in ships, I may here adduce a very similar instance, but stronger to the point, inasmuch as it progressed by groups as well as by isolated cases. It was in H.M. troopship, the *Apollo*, which, in 1849, sailed from Cork, where cholera was present, to take 600 troops to New Zealand, and on the next day a young soldier died in collapse, no other case showing until the tenth day out. On the fifty-eighth day she reached Rio de Janeiro, the day after her last case,—a fatal one. She had carried the infection 4,500 miles across mid-ocean, with a loss of seventeen out of thirty-four cases. There were two bodies of men—the troops and the crew—of whom the latter were attacked in the middle of the fifth week, showing that their infection was derived within the ship, and not from the shore, but from the troops when at their worst, leaving it beyond doubt that an infectious "focus" had been formed in the ship. In the course of her epidemic there were thirty-five days free from any fresh attacks, the intervals being of 9, 6, 5, 6, 5, 2, and 1 days. These instances substantiate the inference that from an individual infected from without, a series of cases may arise by units, or in groups with isolated cases, with intervals extending to the ninth day, *i.e.*, within the range of the in-

cubation stage; cautioning us that within that period, at least, there is no safety for a crew which has presented an initial case of Asiatic cholera.

I do not wish to assume, even with such evidence before us, that cholera is really contagious by external contact, but I take it as proving, at least, that "an infectious aura" will arise where a case of cholera appears in a contracted, over-populated place, as in a ship at sea or in a house ashore. It is improbable that the last man attacked, on the fifty-seventh day out, had taken his infection at Cork.

On the appearance of the *Queen's* first case, the squadron sailed towards the coast of Sardinia, and thus a severe visitation, as the cases were intense, seemed to us to have been averted. After a week's absence from Malta the squadron returned to it, and went in again in pairs between the 29th of August and the 4th of September, when *the Queen entered, together with the Scourge, Terrible, and Hogue,* of which the first three came out on the 8th, and the last on the 9th, proceeding direct to England, and the *Queen* was the only one of them that suffered subsequently. On the day of their going in, the weather was hot, sultry, with a hazy sky, foreboding a change, and there had been no rain for several weeks. On the second evening a heavy gale commenced, and lasted through the night in electric storms. It was a "gregale", or N.E. wind,—the "Euroclydon" of the ancient Greeks—blowing heavily in squalls and gusts, with torrents of rain that washed out the sewers, which was hoped for; but on the early morning of the 7th September there was an increase of cholera in the lower part of the town, crowded with a low-caste population. Unfortunately, the *Queen* was lying at the starting-buoy, nearly abreast of the open mouth of that large sewer, the outpour from which was driven up the tideless harbour by the violent gale. The companion ship lay in Bighi Bay, on the opposite shore of the harbour, remote from the mouth of the sewer, and the steamers were at the coal-wharf, and they were unharmed.

The 6th and 7th September were charmingly cool days, with a clear atmosphere of blue sky with floating white clouds.

The crew of the *Queen* had had a slight return of diarrhœa among them while in port, but it was declining when, on the 8th September, after 87 hours' stay in harbour, she left at 7 A.M., and at 10 A.M. the first case of cholera occurred, which died in six hours; and before morning there were seven cases in collapse, or near it, and three deaths. This was a maximum incubation of 90 hours, dating from entering

the port; but if we date from the scouring of the sewers, it may be reduced by 32, bringing it to 58 hours only. This stage of the epidemic culminated on the 4th day, terminating on the 10th day, and the diarrhœa on the 17th day, when off the coast of Sardinia. In those ten days there were 125 cases of choleraic diarrhœa; 52 attacks of cholera, of which 31 proved fatal either in collapse or by fever, with organic complications—2 cerebral, 3 pulmonary, and 7 muco-enteric. Among the officers there was only one mild case throughout the epidemic.

The *Queen* displayed a greater liability to infection than any other ship in the squadron. She was in the harbour three times, and each time came out infected, when only two other ships did so twice.

In the previous summer (1849) she was cleansed, fitted out, received her stores and a selected crew at Devonport, while cholera was epidemic in the three towns, and she had five cases with three deaths; but after she got to sea there was no new case. The winter of 1849-50 was passed in the bracing and unusually cold atmosphere of Salamis Bay.

On returning to Malta, where a cholera epidemic was incubating from exterior infection, she was the second ship of the squadron to present a case of it, which then rose to a higher pitch in her than in any other ship, and through that summer she showed a higher susceptibility to the virus than any other. I allude to these facts, not that I conceive that her infection in 1850 was in the slightest degree influenced by that of 1849, beyond what is displayed in towns, streets, and houses, where the same have been infected in successive epidemics.

The case of the *Bellerophon* stands the next for consideration. Perhaps no ship was ever in a healthier condition than she was when entering on the 9th of September, and she formed the test of something being wrong in the atmospheric conditions of the port, for a seaman was then seized with diarrhœa, and was sent at once to the hospital, when it was pronounced to be cholera, from which he recovered. Sixty-seven hours after arrival in port, a case occurred, followed by five on that day, and within twenty-four hours twenty-one were despatched to the hospital, of whom thirteen died. All these had had an incubation not exceeding ninety hours, with the lowest at sixty-seven hours from entering the port. The *Bellerophon* proceeded to sea on the forenoon of the 13th, having spent ninety-seven hours in the harbour; and 16 were added to the list at sea that day, 18 on the 14th, 8 on the 15th, 13 on 16th, 8 on 17th, 4 on 18th, 2 on the 19th;

being 69 cases with 7 deaths at sea, which, added to the hospital account of 21 cases and 11 deaths, gives in all 90 cases with 18 deaths, among which there was the rarity of an officer. The contrast of mortality in the hospital, with every comfort and convenience at hand, to that at sea, with but little of either available, affords a very striking example of the advisability of leaving an infected locality and proceeding to sea as early as possible.

The *Frolic*, a brig with 130 men, affords another instance of a violent outbreak consequent on entering an infected port. She was not attached to the squadron, and had passed the summer in the Levant. She arrived at Malta on the 22nd of September, the ninth day after the departure of the *Bellerophon*, when the island epidemic was nearly at an end. As precautionary measures, her crew were not allowed leave on shore, and articles of food were not permitted to be brought alongside for sale. On the 2nd of October, ten days after her arrival, there was a similar outburst in her, with 8 cases on that day, and 13 on the next; these 21 were sent to the hospital, of whom nine died, on board the ship. She went to sea that day, and the disease was at once deprived of all its virulence. The third day presented only 4 attacks, the fourth day 4, the fifth 2, sixth 0, seventh 1, the last, of whom all recovered; the total being 32 attacks and 9 deaths, which latter, of about 8.5 per cent. among 130 men, took place within sixty-five hours from the first attack. As the ship had been in harbour ten days before the first attack, the length of incubation cannot even be guessed at; but from the concentration of the attacks on the first two days, it may be presumed that the essential cause fell like a blast on the crew no long time previous to the outburst; and that although the exposure was long, yet the first and longest portion of it was void of morbific effect. It was even reported to have ceased on shore. These three outbursts were, after the manner of explosions, in full force, without a preceding run of diarrhœal cases. Happily, they got away from the infected island in all haste, and the disease soon came to a standstill in them; the epidemic, that had commenced with fatal cases, terminated also with them, without subsequent isolated cases cropping up. Their brief history seemed to have settled the question of the propriety of going away to sea, as early as possible, even with cases of collapse occurring in a ship. The weather was, however, fine, and the necessity did not arise then for any restriction of good and full ventilation, which they enjoyed by not closing their ports or hatchways. As we proceed it will be seen that in the Black Sea, in 1854,

this explosive force was displayed in several ships of the fleet.

The September portion of this epidemic stands alone for its severity and its special features as illustrations of progress differing in duration after proceeding to sea in different ships, by its affording three fierce outbreaks of epidemic intensity, all occurring within twenty-four days in the same infected port, where an epidemic of four months' continuance was expiring and ending at sea, within thirty-two days from the first exposure of the ship first attacked.

SHOWING THE DURATION AFTER PROCEEDING TO SEA.

Ships.	Days of Exposure.	Previous Day.	Day of Leaving.	Days at Sea.										Attacks.
		Attacks.		2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	
Queen	3	...	7	15	14	1	3	2	4	4	1	1	1	53
Bellerophon.....	4	6	31	18	8	13	8	4	2	...	...	...	...	90
Frolic	10	8	13	4	4	2	...	1	...	...	...	...	...	32
		14	52	37	26	16	11	7	6	4	1	1	1	176

In the first place it is shown that in two ships the epidemic outburst commenced in the port, and in the other on the day of leaving it; and in the second place, that in the *Queen* there was a sudden decline on the fourth day at sea, on the third day the same in the *Bellerophon*, and a pause on the fifth day in the *Frolic*. To account for these, I would say that the infection taken in port ceased on these days, and that the second series arose from propagation in ship. It was obviously the case in the *Queen*, where we find, in the series subsequent to the fourth day, out of 17 attacked, 11 were marines and 7 were seamen, completely reversing the order of the previous part of the epidemic, in which the seamen suffered the most. I cannot assign any other reason for this than that the marines were infected in this mode, because their mess and sleeping-place was contiguous, on the same deck, with the bay where the cholera cases were treated on that special occasion, and where a cholera focus was developed, judging by the events. Dividing the complete returns from her for the epidemic as nearly as possible into three parts, there will be one with twenty-six attacks, and two with twenty-seven respectively, in which the two classes are represented thus:

Epidemic Stages.	Marines, 200.		Seamen, 750.		Total.	
	Attacks	D.D.	Attacks	D.D.	Attacks	D.D.
July and August	4	3	23	12	27	15
September, 1st part	4	3	22	13	26	16
September, 2nd „	15	9	12	6	27	15
	23	15	57	31	80	46

In demonstration of the contrast of proportion of deaths as well as attacks in the first and the last stages of the epidemic.

The marines of H.M.S. *Bellerophon* suffered severely, like those of the *Queen*, and possibly from similar causes within the ship; but on that point I have not much evidence to offer. Her case differed from that of the *Queen*, in that her marines were employed in "fatigue parties" at the dockyard, in removing obsolete stores for transport to England in her; concerning this, however, Dr. Grahame, her surgeon, stated that of those parties, only an officer, who died, and one man, took cholera. Another practical point in the case is, that the ship proceeded to sea with an overwhelming outburst in her, and progressive. The attacked could no longer be sent to the hospital, and of the twenty-one transferred to it, eleven, or 50 per cent., died, so intense were these first cases. No imagination can picture the state of this ship's sick-deck after getting out to sea; through thirty-six hours the patients were laid on mattresses, placed on gratings, and very much of their excreta must have soiled the flooring under and around them. In these circumstances, as I conjecture, there would have been the requisites for a focus of cholera causations, endangering to others, which were aggravated on the second night at sea by a gale of wind, and on the next day the cases were increased. I cannot tell of any other dormitory for the marines than on that deck, nor at what point their infection showed itself.

On the other hand, there were instances of an almost immunity from choleraic action, and this, for some reason, belonged to the smaller vessels (except in the case of the *Frolic*), especially if they were steamers. Of six sailing line-of-battle ships, all were infected in greater or lesser degree, when the *Terrible*, always with the liners, had not a case; nor the *Scourge*, which was so likewise, and when the squadron was off Malta her daily duty was to go in for fresh rations and letters, and any new arrivals or men discharged from the Naval Hospital, and she, strangely, never had a case of the disease. Again, the *Firebrand*, which had a case on

the 4th of July, lay in harbour later as guard-ship twenty-seven days, at the worst period of the epidemic on shore, and with the infection actually brought into the ship in the person of a stranger, who had been entered from the shore to fill a vacancy, and took ill at once, and died.

And lastly, the harbour-ship *Ceylon*, always in a dirty creek, in daily, perhaps hourly, communication with the dockyard, where cholera prevailed extensively, the sufferers obtaining relief from the dockyard dispensary, established in it by the surgeon of the *Ceylon*, presented only two cases of its own in the early part of the epidemic. These, I consider to have been very remarkable examples of exemption.

This epidemic happened at an epoch in our naval history, for, in the same year and in the same squadron, the first experiment was made in the use of steam power for the locomotion of large ships in the line-of-battle—the *Hogue*, of which the name appears in this paper, then joined our squadron with that object in view. She was an obsolete sailing vessel, fitted with engines and an auxiliary screw, which was thought by many to be incompatible with the requirements of a liner. Thus, in the same squadron there were the coincidences that while the executive officers had the first opportunity of studying this novel use of steam power in naval warfare, the medical officers were engaged in combating an enemy more deadly than all the glittering panoply of war, and that on a larger scale than had ever before presented itself in fleets. There were those among them who discussed how the presence of cholera must delay or preclude any warlike action of a fleet, or might even render a fleet impotent against even a despised enemy, to which it might fall an easy prey if the foe were free from the intestine enemy.

Before five years had elapsed, the occasion fell that caused an expedition to be delayed in going to war, and another to return in hot haste after sighting the batteries they had gone to capture.

Black Sea Epidemic of 1854.—In the autumn of 1853, the Mediterranean fleet was ordered from Malta to Besika Bay, off the plains of Troy, where the land is marshy, and, whilst there, ague was much suffered from. On the 4th of January 1854, it entered the Black Sea, and anchored at Sinope on the 6th, from which date it was stationed in the Black Sea until the end of the war with Russia. Throughout the year 1854, the supplies of fresh meat and vegetables were scanty and uncertain, and the former was of bad quality, so that in the first half of the year a scorbutic taint was engendered, complicating the aguish

tendency brought from Besika Bay; but by the middle of the year this was rectified, and a general state of good health was restored. The allied armies then occupied encampments at Gallipoli and Varna, receiving reinforcements from France and Algeria, where cholera was active, and isolated cases were seen in these camps early in June. Early in July a badly infected transport arrived from Marseilles, and landed her troops at Gallipoli; and soon after that some divisions of the French army marched to Varna, losing men on the route. The disease at first held to their camp, but soon extended outside it to the other French camps, and later to those of the English which held friendly intercourse with their allies. About the end of the third week in July the French were suffering badly, and on that account a force of about 9,000 men was detached on a march along the coast-line towards Kostendjeh, starting on or about the 25th of July; of its fate I shall speak later. In the meantime reference should be made to the state of our fleet, which was in two divisions, the greater of which, at Baljick, comprised 9,000, and the lesser, at Varna, 3,000; or in all, in round numbers, 12,000 officers and men, exposed to surrounding choleraic influences, which displayed their morbific action about the same time, but culminating in intense outbursts in several of the ships at Baljick, which did not occur at Varna. Thus, the former suffered, in ratios, per 1,000, to force 65.5, and deaths 35.5, while in the latter these ratios were, respectively, 21.5 and 12.5, showing to that extent a more extensive and severe infection in the Baljick than in the Varna division, in the Michaelmas quarter of 1854, the infection having arisen in both from French sources.

With reference to the epidemic at Varna, I have scarcely any but the statistical evidence for guidance, while of that at Baljick I am able to speak with some assurance, having watched its course from first to last with interest, taking notes of daily occurrences on which I may rely.

On the 7th July, the frigate *Diamond*, of which I was surgeon, arrived at Baljick from Corfu, in excellent health physically, and she anchored inshore of all other ships. On the 9th of July diarrhœal cases occurred in her which the sufferers attributed to the bad quality of the fresh meat issued as rations, complaint of which was brought to the captain by the petty officers. I considered these to be of a crapulous character, although stubborn in treatment; and as the officers using the same rations were not likewise suffering, I spoke lightly of it, till I heard there had been diarrhœa in the ships there before our arrival. On the 12th and 13th fresh

cases showed a decidedly serous character, with prostration. On the 14th a French transport from Marseilles, that had had five deaths by cholera on the passage, came to an anchor inside us, and raised tents ashore, to which her sick were sent, the wind then blowing across them towards us. On the 15th the diarrhœa had increased in us, and in the night there was a case of pronounced cholera, with collapse and rice-water stools, which recovered. It was reported by me as such to my captain, and by him to the admiral, and directions were given to take all precautionary measures, as it was known that the disease in the transport was cholera. A similar case occurred on the night of the 21st.

On my suggestion, the *Diamond* was moved further off shore, and her means of ventilation between decks were greatly increased, and constantly attended to; the accommodation between decks was enlarged by keeping the men's bags on deck at night, and only one-half the crew were allowed below at a time; the contents of the bumboats were carefully examined; cucumbers and unripe fruits were prohibited; water was not issued for drinking that had not rested in the tanks for a fortnight; the crew were medically inspected morning and evening; the corporals were ordered to report to a medical officer any man who seemed to them to be indisposed; and the sentries at the latrines were to report to their sergeant any man observed to visit them frequently. An improvement was well marked through the next four days, but on the 21st July diarrhœa reappeared. On that day the ship went to sea with the fleet, with benefit, but returned with the *Trafalgar* on the 23rd, when she anchored at three miles off shore, and the diarrhœal tendency soon disappeared from her. At that time cholera was steadily gaining in some of the French ships, and two of them had left on that account.

The fleets came back on the 30th July, much improved in health, and several of our crews showed diarrhœa cases promptly. Of them, the *Britannia* was the most susceptible of the prevalent conditions, as, on the next day—the 31st—there was in her a case added to the list as "cholera", which must have gone through the fever-stage, as it remained twenty-four days under treatment. This, it cannot be doubted, was the potential agent of the terrible epidemic that followed, but was practically over by the time the sufferer was pronounced "cured". The next day diarrhœa began to increase in the ship, and cholera incubated seven days, and then gave three cases of it, of which one died on the 8th, and by the 10th there had been three deaths, and much of intractable

diarrhœa. The *Britannia* put to sea on the 12th, with the *Albion, Rodney, Retribution,* and *Diamond,* when the disease seemed to subside at once; but on the 13th an explosion of it occurred in the *Albion,* and on the 14th in the *Britannia.* On the evening of the 13th a gale necessitated the closure of the ports on the sleeping-deck. Towards morning of the 14th a case of cholera presented, and soon the diarrhœa cases underwent a marked deterioration. About 10 A.M. a great and sudden outburst of collapsed cases occurred in the *Britannia.* The first death affords the indisputable proof, as it often has done, of there being cholera in a ship; and the first with a plurality of cases is a cardinal day, showing that epidemic tension has begun. On the 7th of August the first death occurred in the *London;* on the 8th, in the *Britannia;* on the 9th, in the *Albion, Trafalgar,* the *Vengeance, Tribune,* and *Furious;* on the 10th, in the *Rodney;* on the 12th, in the *Vesuvius;* on the 13th, in the *Retribution* and *Sidon;* on the 14th, in the *Queen* and the *Terrible.* There had unquestionably existed in the locality a strong concurrence of choleraic influences before the 30th of July, sufficient indeed to produce severe diarrhœa in the crews then exposed to them, but insufficient to develop into epidemic intensity, which did not arise before the 9th of August. These subsequent occurrences of explosive outbursts raised suspicion that some fresh additional agency had operated to cause them; and that that agency may have been sudden in its incidence, and as rapid as it was potent, was shown in the *Rodney,* the surgeon of which (Dr. Kinnear) stated that up to the day of seizure her crew were *in perfect health,* when ten cases of cholera burst out between 10 P.M. and 4 P.M. That agency would seem to have been present earlier than the 9th of August, since the *Furious,* one of the vessels infected, did not arrive till the 4th, in a healthy state, and suffered a severe outburst on the 9th, without any warning.

This was the earliest of the violent epidemics by as much as four days in the *Albion,* and five in the *Britannia*—ships that had been already five days in the port when she arrived, which seemed to me to prove that within her dates there had been some addition to the localised choleraic influences at Baljick, which I assumed to have been on the return. Possibly those influences at work in the port previously to the arrival of the fleets on the 30th of July may have been sufficient to eventuate an epidemic of cholera; but its rapid development in so many of the ships so near together suggests that some weighty increase to those influences must have suddenly enforced the outbreaks. In my opinion, the

arrival of the cholerised army on shore stood in that relationship on the 7th and 8th of August.

The epidemic came to an end in the several ships—*Furious*, on the 16th of August; *Vengeance*, on the 19th; *Rodney* and *Vesuvius*, on the 20th; and *Sidon*, on the 21st—these were all by final cases; *Britannia*, likewise on the 21st, after clearance and fumigation; the *London*, on the 14th; and *Trafalgar*, on the 16th; but in these there were subsequent recrudescences to the 29th of August and the 7th of September respectively, from within them. The *Albion* had two fatal cases on the same day, that being the last in the fleet at Baljick. On the 8th the expedition left there for the Crimea.

On the return of the French division that had been detached, on or about the 21st of July, to march towards Kostandjeh after the epidemic had broken out in the camps around Varna. On its outward route the division, said to consist of 9,000 troops, was seen on the 25th not far inland from Baljick. On the morning of the 7th of August they had returned to the same spot, reduced by cholera, as rumoured, to 7,000 men. On that afternoon I landed, and walked to their encampment on both sides of the brook that ran through Baljick to the seashore. The soldiers, or many of them, were washing their inner clothing in the brook, and the bushes on the plain were covered with the fruits of their labours, whilst many of them were cleansing their bodies in the refreshing stream. We learned there of their sad catastrophe by cholera of the most malignant type, so much so, indeed, that they had formed the idea of the wells they had drunk from being poisoned. A hasty retreat was decided on, leaving on the plains those who could not march onwards. At daylight these started for Varna, and on the 8th their place was filled up by the stragglers, of whom some others came up on the 9th. We walked back by the banks of the stream to the beach, where we found several large boats of the fleet filling with water from that, its only source of supply, and it demanded no excess of credulity to imagine that evil might ensue from the use of this water. Apprehending bad results to those crews that might be supplied with that water, I represented the fact in that light, and can positively assert that none was taken into the *Diamond*, which was exempt from cholera during the epidemic that was then incubating. I am not able to state with regard to the fleet in general what were the ships that took water from that stream between the 7th and 8th of August, on which day the fleet was in port. Besides this there was naturally much communication going on between the camp and the French

fleet while that was a resting-place, or bivouac, on the 7th and 8th of August. At the same time a hot, dry, northerly wind blew direct from the land across the camp to the fleets at anchor in the bay. This march is alluded to by Dr. Worms (*Gaz. Hebdom.*, 10th Nov. 1865) as "having taken up the space *between* the 21st of July and the 10th of August, and that from the 21st to the 26th of July there were isolated cases, until the 26th, when the epidemic broke out. The loss between the 21st July and 10th of August was 1,953."

The division passed Baljick outward on or about the 25th of July, and again on return, on the 7th and 8th of August, at which time they were suffering from cholera,—or, at least, this may be inferred, as the mortality is brought up to the 10th of August, the date of the main body arriving at Varna, or when it may be supposed to have ceased.

Whilst the diarrhœal cases were being rapidly converted into cholera, of which isolated fatal cases appeared in our ships, and we began to hear that our allies were more grievously infected than ourselves, I came to the conclusion that, at least, the exciting, if not the specific, cause, was to be looked for in the history of the last few days. Certainly, a much more active and an earlier poisoning, otherwise unaccountable for to my mind, had accrued in them, culminating at last in fierce outbursts in some of our own ships, and still more fierce in some of those our allies, who had held much more of intercourse with the infected camp. It is remarkable, too, that one of these outbursts occurred in one of their ships earlier than in any one of ours, and their flagship was reported to have lost about 200 men on the night of the 10th-11th, three days prior to the outbreak in ours.

We may now proceed to consider some of the details in individual ships, of which the *Britannia* was the most severely infected. She had had an epidemic developing in her crew, in the diarrhœal form, seven days before other cases of cholera appeared, three in number, of which one was fatal the next day, the 8th of August; during the next four days there were other deaths on the 10th, 11th, and 12th. On that morning she put to sea, with benefit, as no case was added either on the 12th or 13th, arousing too sanguine hopes that the epidemic was checked. On the evening of the 13th, however, it blew so strong that the ports on the sleeping-deck were closed,* and towards morn a fatal case of cholera occurred, and the men with diarrhœa became worse. At 10 A.M. a multiplicity of cases began to come, mostly with symptoms of collapse, and before night the crew became, as

* The same thing happened to all the battle ships alike.

it were, panic-stricken and death-stricken. The diarrhœal cases were the first to suffer, and soon the cases came in from every part of the ship, even from the yards, so that the deaths commenced within three hours, and in the first twenty-four hours fifty lay dead; and out of the first sixty cases fifty-five perished, and in the first four days there were 201 cases and 93 deaths. In this condition of affairs the ship returned on the fifth morning into port, and the sick, or such of them as could be safely removed, were put on board an empty transport, the *Apollo*, and the sound men into two steam-vessels; and it is well to know that of these, about 700 in number, there were only three attacked with cholera. It was found that the French ships had gone back to Baljick two days earlier, and had sent their sick ashore into marquees and tents, with equally happy results in bringing the epidemic to an end. It has already been shown that in the Malta epidemic of 1850, all the ships benefited by putting to sea into a pure atmosphere, and that their greater visitations ended within five, six, and ten days respectively. It may be added that there was a higher grade of mortality of the cases left in the Naval Hospital than in those that occurred at sea. In the Black Sea, also, it was so at first, as given out on the 13th by the Admiral's signal, "All are improving"; but a gloom came over the scene that afternoon in the *Albion*, followed on the next morning by one in the *Britannia*.

The *Apollo* played a very important part in the epidemic of the *Britannia*, as, within a few hours, there were transferred to her "the selected bad cases", fifty-seven in number, and with them about a hundred and twenty volunteer nurses. Of the former, sixteen, and of the latter, three died. Two days later other ten were transferred, of whom six died; and after another two days, two, of whom one died; and on the ninth day three cases were sent from a transport that had received some of the healthy men of the *Britannia's* crew. In all there were eighty-eight of her men in the *Apollo*, of whom twenty-six died. This hazardous business was conducted by the acting-surgeon of H.M.S. *Inflexible*, Dr. J. Watt Reed. In the *Apollo*, the crew of ninety-six were exposed through ten days, without a consequent case of cholera, affording a very remarkable instance of immunity. Mr. J. Iago Squire was their medical officer.

In point of intensity the *Albion* came next to the *Britannia*. She was a fine, roomy, and a generally healthy ship, and she was always with the *Britannia*, running similar risks. On returning to Baljick on the 30th of July, all was well in her. Diarrhœa soon appeared, gradually increasing in severity,

and on the 9th the first case of cholera appeared, fatal on the 10th, on which day there were five fresh cases, and on the 11th, one; by the 12th there had been three deaths. On that date she went to sea with the *Britannia*, and on it seven cases and one death were noted; and on the 13th, when the *Britannia* was particularly improving, there came an outburst of nineteen cases with six deaths; and on the 14th, thirteen and eleven deaths; 15th, twenty-five and nineteen deaths; 16th, five and four deaths; and on the 17th, five with four deaths, from which day the epidemic may be said to have slowly ended, after ninety-two cases and sixty-eight deaths. The difference in her was the prolongation of her epidemic, arising from her sick having been treated at sea and in port on board her, so that isolated fatal cases appeared up to the 7th of September, the twenty-ninth day from her first case. Inspector-General Mason could tell of the quietude and regularity maintained throughout on board her. On board the *Britannia* an idea prevailed that *a peculiar black cloud* had passed over her and the *Albion* on the 13th, the day of the outburst in the latter, in which no one had observed the phenomenon, which doubtless had produced a depressing effect on the crew of the *Britannia*, the only ship from which it was seen.

The *Rodney* had been a remarkably healthy ship up to the 10th of August, on which day the *Trafalgar*, *Vengeance*, and *London* went to sea infected. At 11 A.M. on that day cholera broke out in her, and in five hours eleven cases of it were put on the sick-list. The epidemic in her was of short duration, ending on the sixth day, but with two recrudescences, and eight deaths. In the *Vengeance* the first death in the fleet occurred on the 6th of August, after ten hours' illness, and her early cases were equally short in their courses. The climax was on the 10th, after which it subsided, ending with thirty-one cases and eight deaths. Her surgeon, Dr. William Graham, told me at the time, that although he had seen much of cholera in the East Indies, he had never witnessed any so severe or rapid as on the present occasion. After cholera had been absent from her six weeks, a boy, who went on board a badly infected transport, had cholera on the following day. Incubation of one day. Other cases bore on the question of incubation less definitely than this.

The *Furious* came into port, healthy, on the 4th of August, and proceeded to cleanse her holds, and to fill up her tanks from the stream. At 4 A.M. on the 9th, a case of cholera occurred, *on the fifth day in port*, and before night a severe epidemic was alive in her. On the 10th she went to sea,

where, at the end of the third day, it declined, and ceased on the eighth day, after twenty-nine cases with nineteen deaths. The *Vesuvius* arrived on the 5th of August; diarrhœa commenced on the 11th, and on the 12th *a case of cholera on the sixth day.* She then steamed to her station at the Sulina mouth of the Danube, where the cholera ceased on the 20th, and dirrahœa on the 22nd, after six attacks with three deaths. The *Sidon* came in on the 9th of August, healthy, and on the 13th, *the fifth day,* a case of cholera presented itself in a boy who had been ashore on the 12th, on which day the ship went to sea, for Kostendjeh. The boy was taken ill, followed by others, to the 21st, with eleven attacks and eight deaths in all. These instances I accept as showing incubations, respectively, one day, of five days in two, and of six days in one.

The case of the *Trafalgar* was equally interesting as an explosion, but in its course it differed in presenting rests and recrudescences. She had been in the infected port seven days before the main squadron returned from a reconnaissance of nine days. There were French ships in quarantine then. Up to the fifteenth day she had had none but diarrhœal cases —a few; on the 16th the epidemic began with ten cases, of which two died the same day; on the next, 17th, there were thirty-nine cases added,—the climax,—sinking next day to six, and rising next day to twenty-two. On the 20th, nineteen cases; 21st, thirteen; 22nd, seven, when the epidemic abruptly ended, recrudescing after four days, for three days, reappearing after twelve days, to be succeeded by an epidemic of influenza. There were 528 cases of diarrhœa. This repetition of recrudescences in ships indicates a series of incubations amongst the crews, showing that the capability or epidemic growth or recurrence is not extinct so long as it lasts. Her exposure was the longest; but the *Diamond,* always in her company, was scarcely touched.

The instance of the *London* resembled the *Trafalgar* in its recrudescences, but there was no outburst in her; almost all were isolated cases, and deaths from day to day, with rests of from three to twelve days' duration; and later she had several cases in the Crimea, from carrying the sick of the army. She presented seventeen attacks, with nine deaths, and only twenty-one of diarrhœa. So long as the fleets remained off Bulgaria, cholera was not extinct in them. Leaving it on the 7th of September, the Crimea was reached on the 13th. On the 7th of September there were six cases of cholera in the *Trafalgar* and *Albion,* and one case in the *London,* in which it showed itself again as soon as the Crimea was

touched, and before the disembarkation commenced. In the *Retribution* there was a case on the 8th, at sea, the day after leaving Baljick,—infected, possibly, by the troopers.

It is noteworthy that in some of the ships, those that remained at sea—as the *Queen*, the *Rodney*, and the *Vengeance*, —infection expended itself, the epidemic was cut short before re-entering the harbour; also in the frigates and the smaller vessels; but this did not happen to others, as the *Albion*, *Trafalgar*, and *London*, which had returned to port with the disease declining in them, but not at rest; and it lingered on or recrudesced up to their finally leaving the port. Perhaps a few days longer at sea would have eventuated in an entire cessation in them all, even in the *Britannia* and the *Albion*, which suffered the most. These ships returned to port on the fifth day, with the epidemic progressing, and it lasted longer in the latter than in the former, which was cleared out at once, after anchoring; but the subsequent histories were such as to raise a doubt whether the loss would have been increased by her remaining at sea beyond what it was in harbour after her return, as the daily fresh cases had decreased much, showing that the climax had been passed in her, and this was more decidedly the case in the *Albion*. The after-crop was certainly more protracted in harbour than in the *Britannia*, which was attributable to the removal of the crew from the midst of what her principal medical officer condemned as "the laboratory of fresh poison", whilst the *Albion* had not that advantage. Epidemicity was put an end to when the infected people were removed from the *Britannia*, as it would appear that none but those who had been poisoned in the *Britannia* showed the disease in their hospital-ship in a manner that destroyed suspicion of contagion from person to person.

The crews were much exposed to cholera infection in loading the transports at Varna, and in disembarking the troops at Eupatoria; and afterwards unloading the stores at Balaklava. Sixteen deaths were attributed to these operations. The Naval Brigade camp also supplied its victims, twelve in number, amongst whom there were two officers.

During the first night on shore in the Crimea, the troops stood in their great-coats under torrents of rain, and were thoroughly drenched; and the next day was dry and hot, and tents were landed. The day after—the 16th—I saw two French storeships bearing the quarantine flag, as cholera hospitals; and we heard that our own troops were also suffering badly, and that a vast number of Russians had died of it in Sebastopol. On the 19th, three of our steam-transports were

sent off, laden with sick, to Constantinople, chiefly filled with cholera and fever. I learned that in the night five cases of collapse had occurred in the *Agamemnon*, of men who had been clearing a transport. On the 20th the battle of the Alma was fought. On the evening of the 21st I visited (to assist in the dressings) H.M.S. *Vulcan*, which was filling with over 400 of severely wounded, with some cases of cholera brought from Eupatoria, of which several died that night, and she left next morning. About noon of the 22nd I was ordered to the beach to separate the choleraic from the wounded as the carts arrived; the former were detained on shore and the latter sent off to transports. In the night seven died out of fifty in a sail-tent. On the next day the army marched towards Sebastopol; and on the 27th, at Balaklava, one of the Commander-in-Chief's staff, in collapse, was received on board the *Diamond* off the harbour's mouth, showing that cholera had traced the route from Old Fort to Balaklava; nor was it ever free from it through the winter. The naval portion of the expedition would, in all human probability, have done with cholera finally, before reaching the Crimean shores, but for its alliance with the army, which transported it in their vessels, and spread it again to the ships of war in disembarking it, and in conveying its sick of cholera from the battle-field of the Alma to the beach, and from thence to their transports, and in unloading the war material from them at Balaklava, assisting the army in every possible way; and, finally, by their active co-operation on the heights of Sebastopol, where all alike were exposed to the same causations, amid insanitary conditions common to all. There it was found that the cholera did not spare the officers, as it does when on board their ships. To the auxiliary operations in the Crimea sixteen deaths in ships were attributed in 1854; and in the Naval Brigade camp there were nineteen fatal cases up to the end of August 1855.*

1854. *Epidemic of the Baltic Fleet.*—This was much larger than that of the Black Sea, all having steam-power, except five liners and an hospital-ship. It was the greatest equipment sent forth since the battle of Trafalgar. It was fitted out hurriedly in the winter, and manned with harbour men, coastguard and volunteers, in which respect it was inferior to that of the Black Sea. It left Portsmouth on the 10th of March, and returned to it on the 16th of December 1854. Some crews were infected with small-pox at starting, and fourteen ships became infected; and whilst it was progressive,

* N.B.—On the authority of Inspector-General Jenkins, C.B., the surgeon of the brigade.

fevers of continued and of intermittent types arose, and in some of the ships a scorbutic taint was engendered. Thus twelve weeks passed before the fleet entered the Gulf of Finland and anchored in Baro Sound, near Sweaborg, where, on the 7th of June, the first case of cholera appeared in the flagship, in the person of a sailor who had been ashore two days previously. Cases of diarrhœa then became more and more prevalent, and on the 15th of June three cases of diarrhœa degenerated to cholera, probably by an infection derived from the primary case, in an interval of eight days. In that ship, the *Duke of Wellington*, with a force of 1,000 men and officers, there were twenty-five cases with twelve deaths between the 7th of June and the end of August, in the course of which she underwent exposure to choleraic influences at Baro Sound, Cronstadt, and Bomarsund. Cholera is stated to have broken out previously, epidemically, from Cape Hango to the head of the Gulf of Finland, and in St. Petersburg. On the 13th the French fleet arrived from France, infected by cholera. On the 22nd, "in consequence of scattered cases of cholera and choleraic diarrhœa having made their appearance in several vessels, the fleet weighed anchor at Baro Sound, and proceeding up the Gulf, anchored off Cronstadt, about three leagues from the land, and near the island of Seskar. From the innermost ship a number of tents were observed, pitched outside the walls of Cronstadt, which were supposed to be occupied by cholera patients." At this anchorage cholera made itself known in several ships previously unattacked, which decided the Commanders-in-Chief, as soon as they had seen the impracticability of attacking Cronstadt without the co-operation of a considerable army, to return to Baro Sound, and on the 6th of July they had got back to that anchorage. The attack on Bomarsund having been resolved on, and the cholera having greatly declined, the anchors were weighed on the 18th of July, and dropped again at Ledsund, near to Bomarsund (Aland Islands), on the 21st of July, to combine there with the land forces and stores for its bombardment. A portion (5,000 men) of the French army arrived from France on the 30th of July. Our liner, the *Hannibal*, conveyed a body of these troops, who brought the infection with them into her, and on the second day, 1st August, cholera broke out again among the troops on board her, and on the next day it began to attack the crew. The epidemic ceased on the fourteenth day, and was absent until the 19th of August. On the 8th the troops were landed, and the guns on the 10th, and at dawn of the 13th the bombardment of two of the forts was opened, and on the

15th they surrendered. On the 15th the breaching batteries opened fire on the great central fort, and continued it through the 16th, when it surrendered, and 2,255 officers and men laid down their arms. As medical incidents, it may be mentioned that cholera was active amongst both the besieged and the besiegers; and on the 19th the prisoners of war were embarked, of whom the *Hannibal*, which had been free from cholera after the 14th, received her quota, "amongst whom the disease existed; it then again spread rapidly among the crew." Altogether, her crew of 500 had 245 cases of diarrhœa, 48 of cholera, 16 deaths; and, by contrast, the *Driver*, with 150 men, which had had a solitary case when off Cronstadt five weeks before, "took on board her 600 prisoners then suffering from cholera, yet the crew entirely escaped the disease."

The Majestic, with 703 men and officers, suffered more than any other ship; there were in her 181 cases of diarrhœa, 42 of cholera, and 23 deaths. Her first case appeared when off Cronstadt, but the epidemic broke out at Baro Sound, and continued in Ledsund, Aland Islands. The field of infection was along the northern shore of the Gulf of Finland, from Cronstadt at its head to Hango Head, and to the Aland Islands, but the ships stationed in the Gulf of Bothnia escaped; so also did those on the southern shore of the Gulf of Finland. The first appearance was at Baro Sound, whence it was carried to Cronstadt, and there aggravated by the local infection; while at sea it declined, and was renewed after returning to Baro Sound, from which it was conveyed to Ledsund and Bomarsund, the French ships and troops suffering the most. One of our ships, the *Archer*, contracted cholera at Memel, the boundary between Russia and Prussia, by seamen who had been left on shore. There had been isolated cases of the disease.

In fifty ships, with 20,630 officers and men, there were 2,118 cases of diarrhœa, 327 of cholera, with 119 deaths. The brunt of this was borne by seven ships, in which, among 5,561 souls, there were 1,134 cases of diarrhœa, 261 cholera, 95 deaths. These were all screw line-of-battle ships, of which class eight others showed cholera in minor degrees, but all of the class were more or less infected. There were five sailing line-of-battle ships, with 3,705 persons, among whom there were only 208 cases of diarrhœa and two of cholera, of which only one proved fatal, although stationed off Baro Sound and Sweaborg, at the mouth of the Gulf of Finland. It is equally noticeable that the frigates cruising in the Gulf of Bothnia, for the most part, had only three cases of

cholera, with no deaths, amongst 4,100 men; whilst in one class, the *Archer*, with 135 men, there were three fatal cases of cholera and 72 of diarrhœa, when cruising of Memel, in Prussia, an infected port, at which the cholera cases occurred in men who had been dissipating in the lowest part of the town.

These contrasts were strong ones, particularly between the sailing and the steam line-of-battle ships, of which the former were under-manned, giving more accommodation with better ventilation, while the latter, of similar ratings, were fully manned, and had their holds and decks hampered with all the extra paraphernalia of steam-ships, by which the crews were overcrowded in smaller space. It may be mentioned, too, that the sailing-ships were supplied with natural water, and the steamers with the water condensed from the steam of their boilers, which, though purer, was not preferred.

The first infection must have fallen on our fleet early in June, and seemed effete, or nearly so, at the end of July, when a new stream of infection arrived from France among troops. These being landed, together with our naval brigade, a fresh infection was imparted to its constituents, who carried it on board their ships on their return, on the 18th of August. On the 28th of August our Admiral Napier made known to the Admiralty that "the cholera is raging, and all the Frenchmen want to get home." From that date no further reference to the cholera appears, and it must be inferred that it disappeared gradually. Previously, a reconnoitre of Sweaborg was made, at which all idea of its capture was abandoned. On the 17th of September the French Admiral commenced sending his fleet home, but the English fleet remained in the Baltic until the 7th, and did not anchor at Spithead until the 16th of December. From these facts we learn the share that cholera had in frustrating the capabilities of the fleet, and in embarrassing warlike operations by sea, undertaken by experienced admirals.

It is remarkable that in the Baltic epidemic there was not a single instance in which the explosive mode of outburst was observed. Epidemic tension was low.

That the Black Sea epidemic in 1854 was the fiercest of the three, is displayed in the ratios per 1,000, of cholera attacks to force, of deaths to force, of cholera to diarrhœa, and of deaths to attacks by cholera, which are the *criteria* of comparative severity on which the Black Sea epidemic stands highest, Malta the second, and Baltic the lowest in order. (*Vide* Appendix I.)

The Parliamentary Report from the Admiralty for these

fleets in the Black Sea and the Baltic for the years 1854 and 1855 (p. 112), states that "the proportional loss in a given amount of force was nearly—from cholera, and cholerine or choleraic diarrhœa—eight times greater in the former than in the latter. In one ship alone, the *Britannia*, it exceeded, in 1854, by about one-half the total mortality in the whole force in the Baltic in the two years." The total loss by cholera in the Black Sea, in 1854-55, was 489, of whom 359 died in the epidemic at Baljick and Varna, and 50 in the Crimea, up to 31st December 1854, and 80 in 1855. The total loss in the Baltic in 1854-55 was 111, of whom 108 died in 1854, and only three in 1855. These marked differences are best accounted for in that the Black Sea fleet wintered there, thus maintaining the chain of causations from year to year, that of the Baltic having been broken by a return to England through the winter of 1854-55.

From naval reports it is learned that cholera was seen on the Indian Station in our ships of war, yearly, from 1837 to 1841, but the aggregate was low and the mortality small. In 168 cases there were 28 deaths: 166 per 1,000 of attacks. In 1842-43 it appeared in the Yangtse-kiang, in ships, on their arrival of Che-keang-foo, at the mouth of the grand canal to Pekin, and it harassed our troops after landing. Canton river and Amoy were free from it. In those years there were in our ships of war 294 cases and 80 deaths: ratio per 1,000, 272; being 106 higher than the above mortality in the Indian seas in the preceding years. This was in our first war with China.

In the second war (1857-59) Canton was taken, and garrisoned by two battalions of Royal Marines till the end of the war; and for the siege of Canton an additional force of blue-jackets was landed, but they returned to their ships soon after the capture of the city, in which they suffered considerably by wounds; but it being in the winter, they retained health. In the spring of 1858 cholera appeared in the worst part of the city, and it spread to the marine battalion quartered there, and some cases appeared in the battalion quartered on the heights overlooking the city, and later the ships up the river began to suffer. One of these was despatched to Hong-kong with a regiment, and the disease broke out among them while in the river, and after her arrival cases appeared in ships anchored there. Cholera also showed itself in vessels at Singapore, Amoy, and Shanghai, proving its general diffusion. It was also at Nagasaki, in Japan, to which it was said, by the Japanese, to have been brought by English and American ships of war from Shanghai, which seemed to us to be probable.

Whilst these events were transpiring in China the squadron in the Gulf of Bengal were suffering badly. It had happened that when the land expedition destined for China reached the Straits of Sunda, news of the mutiny in India was received, which diverted the troops to the Hooghly, and more ships were sent there. On their arrival, two ships' companies were formed into two naval brigades, as artillerymen, with guns from their ships. Of these, the *Shannon's* proceeded to Lucknow in time to be present at its capture, after the loss of its gallant captain, Sir William Peel. The loss by cholera in the Indian squadron, compared with that in Canton, is seen in Table III, showing that it was greater in the former, both ashore and afloat, on war service. The only speciality of the year was in the *Megæra*, a steam-trooper, which received three well-defined infections: first, in February, in dock at Calcutta, from which she was hurried to Melbourne, and returned in June with a regiment, all in excellent health. The regiment went into barracks, and in three or four days they were attacked by cholera, and about the same time the crew were badly suffering; but on the 7th day after her arrival she left for the Cape of Good Hope, and having to batten decks, the disease increased, so that between the 3rd and the 17th day after her return to Calcutta there were 18 cases of cholera and 60 of diarrhœa, of which 14 died. She was absent from Calcutta 21 weeks, and on the eleventh day cholera reappeared.

In 1860 cholera was at rest in China, and in 1861 all bowel diseases were greatly subdued, but in that year the *Centaur* lost a man by it at Nankin, where she was on account of the Taeping rebellion, which spread the disease wherever its undisciplined hordes appeared. In 1862 they advanced towards Shanghai, which was protected by our ships as well as by forces ashore. They had made themselves possessors of a fortified town—Kahding—on a branch of the Yangtse-kiang, about 40 miles from Shanghai, and a mixed force of Chinese troops, an English regiment, artillery, and a naval brigade of 500 men, was formed to dislodge them, and started on the 22nd of October, the troops going by land, and the brigade by water, with the army stores.

On the previous day the *Euryalus* had arrived with her crew of 500, in good health, not having landed since leaving England, six months before. A smaller supplementary brigade of 217 men was formed in her with all despatch, and left Shanghai later on the 22nd, in chop-boats with Chinese rowers, like the main brigade, but in unsheltered boats, and without a supply of pure water from Shanghai, beyond what

was taken by the Chinese rowers for themselves, with which the first brigade also was amply furnished, and thus they had none but the polluted water of the sluggish, muddy stream to drink. Although later, they proceeded on the same day, but on arriving at Kahding on the 24th, they found the object of the expedition obtained—the Taepings had fled, the Chinese troops were put in possession of the town, and the British troops were on their return to Shanghai, to which also the main naval brigade was on its way. The *Euryalus'* division remained at anchor off Kahding that night, and on the morning of the 25th it landed and scoured the country around Kahding for rebels, without discovering any signs of them, and then returned to their chops. During the night, about 10 P.M., the first case of cholera occurred among them; and, about the same time also, in the main division that had left on return, the day before, four men being attacked, who all died on the river.

In the *Euryalus'* chops the first case was rapidly fatal. Other cases followed in quick succession, until the greater portion were more or less under the influence of the choleraic poison in some form or other. On the morning of the 27th they regained the *Euryalus*, with 15 cases of collapse, of whom 14 died—ten in collapse, four in coma, and one of supervening dysentery, after complete reaction from collapse. Among 217 officers and men there were in all 40 cases of cholera with 21 deaths, being 525 per 1,000. After their return, of those who had not left the ship, only two men suffered by choleraic diarrhœa, one of whom had attended on one of the fatal cholera cases.

It was remarkable, that of the 1,500 of our troops that marched to Kahding and back again, none suffered, and all were said to have benefited; but they had recently undergone severe losses by cholera, after their first arrival at Shanghai. The disease was confined to those who had gone by the river; and of them the 500 who preceded had only four cases, all fatal, who were attacked in the same night, lower down the river, as the 2nd division. They were acclimated to the surrounding choleraic conditions, and drank good water taken from Shanghai in their chop-boats, having a deck over them, and had not undergone the fatigue of a heavy march across the fallow rice-fields around Kahding. Immunity was enjoyed in the 2nd division by the auxiliaries in charge of the army stores, who, like the 1st division of the naval brigade, were provided with pure water at Shanghai; and even the Chinese boatmen similarly situated likewise escaped. All the men of the *Euryalus*, in common, had for

drink none but the water of a stream that ran through the plain and under the walls of Kahding, held by the Taepings, who had spread cholera wherever they appeared, and by whose excreta the stream was in all probability contaminated.

The history of this short epidemic of cholera affords an instance as striking as that recorded of the Broad Street pump, as to the existence of a specific germ of cholera, and its transmission through the medium of foul water, perhaps the more instructive through its having been in boats. An equally important and instructive fact was told by Dr. D. Lloyd Morgan, the fleet-surgeon of the ship, from whose official report these notes are abstracted, showing that the paludal germs of dysentery and remitting fever may be received synchronously, if not co-operatingly, with the specific germs of cholera, the latter with a maximum incubation of four, and the former eleven, days from the first exposure. The first case of cholera was on the 25th of October, and one of the men who recovered was attacked with dysenteric symptoms on the 1st of November, and was convalescent on the 9th, when fever of a remitting type supervened, and was followed by diarrhœa. Another case of cholera, that was followed by fever of a remitting type, terminated fatally by dysentery, attended by low typhoid febrile symptoms. These cases seem to indicate a complication or a co-existence of poisons, something similar to what was noticed by me in the Canton river in 1858, and mentioned in a paper on the diseases found there, with especial reference to dysentery and enteric fever, read before this Society on the 10th of March 1861, my impression being of a correlation in the causations. Dr. Morgan was enabled to bring the question within a narrower circle, and to show that the combination of the causes of these diseases—cholera, dysentery, and remittent fever—may be comprised within four days, the incubation differing from a minimum of four in the first, and of eleven days in the other two, after their first entering the river.

The coincidence of these diseases is of interest in an etiological as well as in a pathological sense, and could not be presented in a narrower field. Cholera is believed to arise from a specific cause, probably of a microbic character, while dysentery and remittent fever are conceived to be of paludal origin. The causes were co-operative, within four days, on a foul river, in a sub-tropical country; and the incubation of the former disease began to produce cases within four days, when the latter showed no development until the fourteenth day of exposure, and then what remained of choleraic changed into the dysenteric type of disease, running

on in several instances to the most destructive lesions, but in no way infectious to the men of the ship who had not been exposed in the boats on the foul river, the drinking from which was the only ostensible cause of paludal poisoning. I am not aware of any other example of such a combination of tropical and sub-tropical causations, with results so fatal as these: of 217 persons yielding fifty-two cases, with thirteen deaths, in ratios per 1,000, of 885. to exposure, and 177. of deaths to attacks.

The distribution and the mortality of this complex epidemic show that the collapse of cholera was more fatal by far than the combination of dysentery with remitting fever. The entire deaths out of 217 persons was 156. per 1,000, of which 96.6 were by cholera, and 60. per 1,000 by the complicated diseases.

Dr. Morgan remarks: "This is not the first time that it has been my lot to witness cholera, paludal fever, and dysentery dovetailing, as it were, into one another. Is it possible that there can be two or three kinds of poisons, possessing different periods of incubation, germinating in the human system at the same time, and becoming manifested in the order in which they relatively become matured?" The evidence adduced by him from this epidemic is, to my mind, affirmative of this proposition, as its unique complications were limited within a very small circle as to persons, time, and locality; and the only other smaller group of cases, on the same occasion, in the first division of the naval portion, appeared as choleraic poisoning only in four fatal cases, both divisions having been subjected to the evil influences of a polluted river, of the water of which the first division had been compelled to partake; whilst, in the second division, a few might have drunk without the same absolute necessity to rely on it entirely to quench thirst. As to the dysenteric complication, which affected only the second division, I believe that very many naval surgeons have contended with that disease on tropical and semi-tropical rivers, for which no other reason could be assigned than the drinking of the water of the stream that flowed by them, laden, perhaps, with paludal emanations that give rise to dysenteries and remitting fevers.

If similar cases had appeared among those who did not leave their ship, either during the absence of those who were attacked or after their return, there would have been reason to suspect a wider diffusion of the morbific causes; but these were clearly limited to one division of those who were in boats on the river, in which the Europeans were unacclima-

tised. In the epidemics of cholera I have dwelt on, in the seas of Europe, dysentery was more common than in ordinary years; and it was far more numerous in the Black Sea than in the Baltic, and in both it was proportionable, in a great degree, to the amount of cholera in the ship. The diarrhœa was of two types—choleraic and dysenteric—each being a milder form of the respective diseases; and my own experience was, that where the choleraic type was weak the dysenteric was stronger. My opinion was of a certan amount of correlation between the courses of these two diseases, and if that were correctly formed, then the same may be applied to the conditions observed in the *Euryalus* in a Chinese river, whereon Dr. Morgan hazards an impression "that the malarious poison, as well as the choleraic, was conveyed in this instance through the medium of the river-water, which the men freely drank of."

In the early part of this paper I spoke of the successions in following years, in 1782-3, at Madras, of cholera in its most intense type of cramps and collapse, preceding an epidemic of tetanus, in both of which the phenomena arise from excessive irritation of the sympathetic and the reflex nervous centres. Now, I may point to the small epidemic in the *Euryalus* in China, as exhibiting, in time and place, the coexistence of cholera with diseases of unquestionably paludal origin, and subsiding into them, viz., topical dysentery and its ally, remittent fever, the ostensible lesions in which are confined to the mucous surface of the lower intestines and the liver.

I must now bring to an end the detail of what I deem to be interesting points in the history of Asiatic cholera, as it has presented itself at various periods in our fleets. It is true that the disease is the same in its causations and course alike on land and on sea—the specific cause being the same; and its phenomena are similar, but by the predominance of one or other of these, a different complexion may be imparted from the diarrhœal to the flocculent stool, in the eliminative, and from the mild cramp to the semblance of tetanus in the nervous symptoms, according to the exoteric conditions. These exoteric conditions vary in force according to the local attention devoted to the removal of insanitary, and the perfecting of sanitary, conditions of person as well as of place, such as are being carried out in our municipalities, under the guidance of the Local Board and Home Office.

Analogous principles have been applied in our navy since the Russian war, and many modern ideas of sanitation introduced in the new style of ships have worked out much benefit

as regards health in the course of thirty years. Although malignant cholera has very frequently got into ships of the navy since then, yet we have proof of improved modes of dealing with the "initial cases" than was formerly exhibited. There has been since then no other case so special as that of the boats of the *Euryalus*, and this appears to have been owing to the extreme haste in the preparation of the expedition. The latest annual Blue Book for 1884, shows that the ratios per 1,000 to force, of cholera during ten years, has fallen to .5, and of deaths to .08, which shows a vast advance by means of naval hygiene.

Mr. President and gentlemen, I have attempted to lay before you a brief survey of the history of Asiatic cholera in its visitations to our fleets. The subject is a wider one than I have been able to comprise in this reading, which it would have been a pleasure to accomplish completely. I must ask your indulgence to postpone the reading of the deductions I am prepared to offer for your consideration, mentioning only now that these include the following topics: On the incubation and the latency of the specific causation; on the modes of development of epidemics in ships and fleets; on the susceptibility and the reverse to the specific causations; on the correlation of cholera, dysentery, and remittent fever; on the sanitation of ships, preventive of the spread of cholera in them; and lastly, on the detention of those arriving at healthy ports, after suffering by cholera on their voyage.

INDEX TO THE TABLES IN THE APPENDIX.

I.—The General Conditions subsisting in the Epidemics of 1850 and 1854.

II.—The Special Conditions of the same in the several Ships infected.

III.—The Daily Rates of Growth and of Decline of these Epidemics, as shown by fresh Daily Attacks, and Deaths.

IV.—Cholera in Squadrons and Ships on the East Indian and China Stations in 1858.

I.

Statistical Table of Three Epidemics in Fleets at Malta, in the Black Sea, and in the Baltic.

Localities and Dates of Three Epidemics.		Statistical Elements of the Epidemics.													
		Exposed Forces.	Attacks and Mortality to Force.						Ratios per 1000.						
			Diarrh.	D.D.	Cholera	D.D.	Conjoint Attacks.	D.D	Attacks.			Deaths.		Cholera to Diarrhœa.	Deaths to Attacks.
									Diarrhœa.	Cholera.	Conjoint.	Cholera.	Conjoint.		
		I.	II.		III.	IV.	V.	VI.	II ÷ I.	III ÷ I.	V ÷ I.	IV ÷ I.	VI ÷ I.	III ÷ II.	VI ÷ III.
		Complete Statistics of Three Epidemics.													
Malta.....	1850	6,460	1050	1	397	105	1447	106	162.5	61.45	224.0	16.25	16.40	370.1	267.0
Black Sea.....	1854	12,004	3419	4	655	359	4074	363	284.8	54.50	339.4	30.00	30.21	191.6	550.3
Baltic	1854	20,630	2118	1	327	119	2445	120	102.6	15.80	118.5	5.77	5.82	154.4	171.4
Total	...	39,094	6857	6	1379	583	7966	589	175.1	35.27	203.7	14.91	15.07	201.1	427.1
		Fifty-five Ships with Cholera.													
Malta.....	1850	5,535	893	1	397	105	1290	106	161.3	71.72	233.0	18.97	19.15	444.6	...
Black Sea.....	1854	11,231	3204	3	655	359	3859	362	285.3	58.30	343.6	32. 0	32.23	204.4	...
Baltic.....	1854	11,948	1668	1	327	119	1995	120	139.6	27.50	116.9	9. 9	10.04	196.8	...
Total	...	28,714	5765	5	1379	583	7144	...	...	...	...	...	...	...	...
		Thirty-nine Ships with Diarrhœa only.													
Malta.....	1850	925	157	1	...	...	157	1	169.7	...	...	...	...	...	...
Black Sea.....	1854	773	215	...	...	...	215	...	278.1	...	...	...	..	...	...
Baltic	1854	8,682	450	...	...	...	450	...	51.8	...	...	...	...	...	...
Total	...	10,380	822	1	...	...	822	1	70.91	...	...	...	...	...	...

II.

Cholera in Ships of War.					Incubation.			Epidemic.		Duration.			Extent and Ratios per 1000.					
	Years.	Places.	Names of Ships.	Force.	Days of Exposure.	First Case of Cholera.	First Death.	Epidemic Outbreak.	Climax of Epidemic.	From First Exposure.	From First Case.	From First Death.	Diarrhœa Cases.	Cholera Cases.	Per 1000 to Force.	Deaths.	Ditto to Force.	Ditto to Attacks.
1	1850	Malta	Bellerophon	750	1	1st	3rd	3rd	2nd–3rd	11	11	8	61	90	127.	18	39.	232.
2	1854	Baljick	Britannia...	1040	2	2nd	4th	11th	9th-12th	22	10	12	396	229	220.	139	134.	602.
3	1850	Malta	Queen	996	4	4th	4th	4th	2nd–3rd	15	11	11	113	53	53.	31	31.	285.
4	„	„	Queen	996	5	5th	5th	...	... ...	8	3	3	12	2	2.	2	...	...
5	1854	Baljick	Furious ...	190	5	5th	5th	5th	2nd–3rd	10	6	6	72	29	152.	19	100.	655.
6	„	„	Sidon	291	5	5th	6th	6th	2nd–4th	13	9	8	61	11	38.	8	27.	727.
7	„	„	Vesuvius ...	155	7	7th	9th	...	... ...	15	8	8	13	6	38.	3	19.	500.
8	„	„	Vengeance	750	8	8th	9th	11th	3rd–4th	21	14	13	406	30	40.	18	24.	600.
9	„	„	London ...	804	9	9th	9th	...	... ...	...	...	...	21	26	21.	15	11.	531.
10	1850	Malta	Frolic	130	10	10th	10th	10th	2nd ...	16	6	6	11	32	46.	9	9.	69.
11	1854	Baljick	Albion	800	11	11th	12th	14th	15th-17th	24	14	14	322	97	21.	68	85.	501.
12	„	„	Tribune ...	328	11	11th	11th	...	... ...	...	...	...	72	2	6.	2	...	...
13	„	„	Rodney.....	808	12	12th	12th	12th	1st–3rd	17	5	5	159	28	32.	11	10.	308.
14	„	„	Retribution	302	15	15th	15th	...	... ...	...	...	...	87	2	6.	2	...	...
15	„	„	Queen	942	16	16th	17th	...	... ...	...	...	...	144	5	7.	5	...	...
16	„	„	Trafalgar...	903	17	17th	17th	17th	2nd–4th	20	13	14	523	127	132.	39	36.	273.
17	„	„	Terrible ...	306	24	24th	24th	...	... ...	...	...	...	...	3	...	3	...	...

H.M.S. Bellerophon, on the third day in an infected port, cholera broke out in her in epidemic type, which was at its climax in the next and following days, and ceased in its collapse form on eleventh day from first exposure, and eleventh after the first case. There were 61 diarrhœas, 95 cholera cases with 22 deaths, with ratios per 1000 of 127. to Force, and of 39 deaths to Force, and 232 to Attacks of collapse cholera.

III.—*Progress and Decline of Epidemics in the above Ships.*

	Ships.	Days of Exposure.	In Port. Att.	In Port. D.D.	Departure. In Port. Att.	In Port. D.D.	At Sea. Att.	At Sea. D.D.	2nd. Att.	2nd. D.D.	3rd. Att.	3rd. D.D.	4th. Att.	4th. D.D.	5th. Att.	5th. D.D.	6th. Att.	6th. D.D.	7th. Att.	7th. D.D.	8th. Att.	8th. D.D.	9th. Att.	9th. D.D.	Days at Sea.	10th. Att.	10th. D.D.		11th 26th Att.	11th 26th D.D.		Oct. Nov. Att.	Oct. Nov. D.D.	Duration.	Totals. Att.	Totals. D.D.
1850	Bellerophon.....	1	6	4	15	7	16	1	18	1	8	1	13	1	8	1	4	1	2	...	...	...	...	1	...	...	...		...	...		...	...		90	18
1854	Britannia	2	7	3	...	...	...	1	...	...	75	13	59	45	38	21	18	14	20	14	8	9	4	5	5	...	2		...	12		...	...		229	139
1850	Queen	4	...	...	...	...	7	1	15	6	14	9	1	3	3	2	2	1	4	2	4	2	1	1	...	1	3		1	1		...	...		53	31
1850	Queen.....	5	...	...	...	...	...	...	...	...	1	1	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...		...	...		...	...		2	2
1854	Furious.....	5	2	2	6	5	3	3	8	5	5	2	3	1	1	...	1	...	...	1	...	...	...	...	6	...	...		...	...		...	...		29	19
„	Sidon.....	5	...	...	...	...	...	...	1	1	5	1	1	1	...	1	1	...	...	...	2	1	...	1	...	1	1		...	1		...	...		11	8
„	Vesuvius	7	...	...	...	...	1	1	...	...	1	...	2	1	1	...	...	...	1	...	...	...	...	1	...	...	...		...	...		...	...		6	3
„	Vengeance.....	8	4	3	3	1	6	3	5	3	1	2	...	1	3	1	7	1	...	1	...	...	...	...	9	1	1		...	1		...	...		30	18
„	London.....	9	1	1	...	...	...	...	1	1	1	...	...	...	2	1	1	...	...	1	...	...	...	...	1	9	3	1		7	3		10	6		26	15
1850	Frolic	10	8	4	13	5	...	...	4	...	4	...	2	...	...	...	1	...	...	...	...	...	...	...	...	...	...		...	...		...	...		32	9
1854	Albion	11	7	2	...	...	7	1	19	6	13	11	25	19	5	4	4	5	6	5	4	4	1	3	5	1	1		3	5		2	2		97	68
„	Tribune.....	11	1	1	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	7	...	...		...	...		...	...		2	2
„	Rodney	12	...	...	4	2	6	3	2	...	3	...	1	...	3	...	...	...	...	...	1	...	1	...	8	...	...		5	1		4	3		28	11
„	Retribution	15	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	...	...		1	1		...	...		2	2
„	Queen	16	...	...	...	...	1	1	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	9	...	...		...	...		3	3		5	5
„	Trafalgar	17	10	2	6	1	33	6	6	7	22	3	20	4	13	4	7	4	1	2	...	...	...	...	7	...	...		5	4		4	2		127	39
„	Terrible.....	24	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...		2	2		3	3
	Attacks	...	47	...	47	...	80	...	80	...	154	...	127	...	79	...	46	...	34	...	18	...	6	...	...	7	...		22	29		25	...		772	...
	Deaths	...	...	23	...	21	...	21	...	31	...	44	...	76	...	37	...	26	...	27	...	17	...	13	...	...	9		...	...		...	18		...	392

Cessation of Epidemic Tension, 27th August.

From recrudescence at Baljick, 7th Sept., to Crimea, 29th Sept.

Malta, 1850, Sept. 8th to 20th.

Black Sea, 1854, Aug. 7th to 29th Nov.

RATIOS PER 1,000.

Force.	To Force. Attacks.	To Force. Deaths.	To Attacks Deaths.
11,990.....	772	392	...
Ratios.....	64.5	32.7	507.

1858. CHOLERA IN CANTON RIVER.

Ships, etc.	Force.	Attacks.	D.D.
Actæon	130	5	2
Adventure	120	3	3
Assistance	120	5	2
Calcutta	685	3	...
Cambrian	340	2	1
Esk	210	1	1
Furious	225	1	...
Hornet	160	4	2
Nankin	450	2	1
Princess Charlotte	260	2	1
Sans-pareil	520	3	2
Volcano	70	1	1
Eight Gun-boats	435	1	1
Macao Fort	40	...	...
	3765	33	17
Canton Garrison	1700	35	15

	Ratios per 1000.		
	Attacks to Force.	Deaths to Force	Deaths Attacks.
Force afloat	8.75	4.5	515.
Force in Garrison.	20.	8.6	438.
Total	12.5	5.6	470.

1858. CHOLERA ON EAST INDIA STATION.

Ships, etc.	Force.	Attacks.	D.D.	Remarks.
Megæra	150	24	17	* These cases were at Calcutta in the spring, before departure of the greater part of her crew in her Naval Brigade (that reached Lucknow), in which six men died, and are counted with three of the Pearl, making nine deaths in the Naval Brigades.
Mohawk	85	14	9	
Pylades	260	23	12	
Rosbuck	105	3	3	
Shannon*	400	9	5*	
	1000	73	46	
Naval Brigades of Shannon and Pearl	600 (Assumed.)	15	9	Six of Shannon, three of Pearl.

	Ratios per 1000.			
	Attacks to Force.	Deaths to Force.	Deaths to Attacks.	† The above changes necessitate another in the Force, by adding to 1000 as above 340 for the Pearl's crew, although her deaths were all in the Brigade, not in Ship.
In Ships	73.	46.	630.	
In Brigades	25.	15.	600.	
Totals†	65.6	41.	625.	
Comparison of the two Stations.				
Afloat, Canton River	8.75	4.5	515.	Shows that the ships at Calcutta had a worse infection than those in Canton River; and the Naval Brigades in India worse than the garrison of Canton; the totals, ashore and afloat, being greatly in favour of the forces in China over those in India.
„ India	73.	46.	630.	
Ashore, Canton River	20.	8.6	438.	
„ India	23.	15.	600.	
Total, Canton River	12.5	5.8	470.	
„ India	65.6	41.	625.	

OBSERVATIONS ON A CERTAIN MALADY OCCURRING AMONG COWS AT A TIME WHEN THE MILK PRODUCED BY THEM DISSEMINATED SCARLET-FEVER.

By JAMES CAMERON, M.D.,
Medical Officer of Health for Hendon.

(*Read: April 14th*, 1886.)

Mr. President and Gentlemen,—I wish to lay before you a short description of a cow-disease which has been the subject of investigation by Mr. Power, Dr. Klein, and myself during a recent inquiry into an outbreak of scarlet-fever which occurred in the districts of St. Marylebone, St. John's Wood, Hampstead, and Hendon, amongst consumers of milk derived from a dairy-farm situated within my sanitary district.

Mr. Power, in his report, which will shortly be presented to the Local Government Board, will give the history of this outbreak; the circumstantial evidence proving its connection with the milk from this farm; and the circumstantial evidence also which led to the discovery of this disease amongst the cows. As the pathology of the disease, which is of a most interesting nature, is being minutely investigated by Dr. Klein, I content myself, in this paper, with dealing with the broader features of the malady; laying before you its signs and symptoms, so far as they have come under my own observation; and stating also what I have been able to learn about it from such sources of information as have been open to me.

This disease is certainly not a new one. It has been known to some farmers and cow-keepers at any rate, as a catching malady, under the designation of sore-teats, blistered teats, and the like, but it has never hitherto been recognised or described as a specific contagious disease amongst cows, or considered to have any concern with the causation of scarlet-fever in the human subject. It is a disease which does not often endanger the life of the cow, although it may seriously affect its health for a time, and commonly it has been regarded as a malady of little importance.

The farm at which this outbreak of disease occurred may

be described as a model one. It is essentially a dairy-farm for the production of milk for the London market. About a hundred cows constitute the herd, and they have been continuously housed in three well-built, clean, and well-ventilated cow-sheds. An abundant supply of West Middlesex water is laid on to each shed; the cows have been well fed, carefully looked after, and the sanitary arrangements of the farm are and have been good.

The farmer has not been in the habit of keeping calving cows on his farm, but has purchased newly-calved cows from agents. His cows, when approaching the end of their milk-giving period, have been fattened for the butcher, and new ones bought to fill their places, so that frequent changes have been taking place amongst his stock. So far as his knowledge guided him, the farmer took every precaution to prevent the introduction of contagious disease into his herd. He had provided a quarantine-shed, in which he placed all newly-purchased cows for a week or so, before placing them with the rest of his cows, so as to avoid introduction to the herd of pleuro-pneumonia, or foot-and-mouth disease.

Three newly-calved cows were purchased from an agent on November 15th, about a fortnight before the first cases of scarlet-fever occurred among consumers of the milk, and were placed in the quarantine-shed for a week or more, being subsequently placed in the largest cow-shed.

On December 4th four additional newly-calved cows were purchased from another agent, and also placed in the quarantine-shed for one week. Two of these were then placed in the largest shed beside the first three, and two in another shed. It was subsequently ascertained that one of the three first-mentioned cows was the first sufferer from the disease that is in question, and that she introduced the disease into the herd; but whether she suffered from this disease while in the quarantine-shed, and before being placed in the big shed, I have not been able to ascertain from the cow-man in charge of her; but I have little doubt that such was the case, as the cows of December 4th, which followed her in the quarantine-shed, were the next to suffer from the malady, one of them being eventually purchased by Government for examination by Dr. Klein.

This malady was thus introduced into the big shed late in November, and subsequently spread among the cows in that shed. The next shed to be affected was the one into which two of the second lot of cows had been introduced about December 11th; and lastly, the cows of another shed which had received none of the suspected cows, but had probably

received the poison mediately by the hands of the cow-men. By January 5th, when a second cow was purchased for experimental purposes, the whole herd of a hundred cows, with very few exceptions, was suffering from the same disease, to a greater or less extent, and all the milk had been returned upon the hands of the farmer, who had to throw it away, at great loss to himself.

From first to last the disease was looked upon by the farmer and his cow-men as of no consequence at all, and the farmer would not believe that there was anything the matter with his cows beyond blisters and sores on the teats, which he said were caused by the cold weather.

On my first visit to the farm, on December 17th, I noticed one of the second lot of cows breathing quickly, and she continued to do so for a good many days (about a fortnight) before the vesicles were noticed by us on the teats. This quickened breathing was attributed by the cow-men to the cow having been taken from open fields in the country to be placed in a warm cow-shed at this farm; but there was evidently some other cause for it. From this cow lymph was taken on December 31st by Dr. Klein for experimental purposes. During the last fortnight of December Mr. Power and I had visited the farm repeatedly, but had not specially examined the cows, preferring to be guided to the malady, if any existed, by such circumstantial evidence as we could procure. On the 28th certain evidence was obtained, which showed that some of the cows in the first suspected shed were suffering from bad quarters. This led us to examine the cows carefully, when, besides the cases of bad quarters, several of the animals were found to be suffering from this particular malady.

In connection with this farm, and the introduction to it of the cow malady in question, I need say no more in anticipation of Mr. Power's more complete report, beyond stating that, almost coincidently with the spread of the disease amongst the cows and into the various sheds, scarlet-fever made its appearance, and continued to prevail among the consumers of the milk procured from these sheds.

In entering upon a description of this cow-disease, it is necessary to note that what I have to say has not all of it been the result of personal observation. Especially is this the case as regards some of the earlier symptoms, which, of necessity, have been learned from other persons. The account of these, therefore, though I have taken great pains to sift the statements made to me in this connection, and, indeed, believe them to be fairly accurate,

must be held liable to future correction or modification. But the account I give of the course of the disease after the appearance of the eruption on the teats and udder is my own, and is, I think, less subject to qualification in the above sense.

From my own observation, together with what I can learn respecting it, the disease would appear to be capable of general description as follows.

A specific contagious and infectious disease, occurring usually in the first instance amongst newly-calved cows, and capable of being communicated to healthy cows by direct inoculation of the teats with virus conveyed by the hands of the cow-man after milking a diseased cow, and perhaps by discharges from the mouth, nose, and eyes of infected cows coming in contact with the manger at which other cows may feed. It has been communicated to man* by inoculation with virus from the vesicles on the teats and udder, and seemingly, it is communicable, *though perhaps in another form*, through the medium of the milk. In the cow it is characterised by general constitutional disturbance; a short initiatory fever; a dry, hacking cough; sometimes quickened breathing; sore-throat in severe cases; discharges from the nostrils and eyes; an eruption on the skin around the eyes; an eruption on the hind-quarters; vesicles on the teats and udder; alteration in the quality of the milk-secretion, and well-marked visceral lesions. The actual disease may continue in the animal for from four to six weeks, and it would seem that in some cases subsequent ill-health may last for from two to three months, or even longer, causing great emaciation and debility. It is difficult to speak of the fatality of the disease, but it would appear that sometimes, though rarely, cows have died in its course, perhaps from affections of the internal organs.

Besides attacking by preference newly-calved cows, the disease is especially prone to attack cows that have been in low condition of health before calving, and cows which have slipped their calves. In cows where, after calving, there may have been retained portions of membrane or placenta, and where the cleansing has been imperfect, with an offen-

* A trustworthy informant received the virus of this disease into a recent scratch upon his forefinger while milking a diseased cow. He suffered from general weakness, malaise, and loss of appetite. About four or five days after inoculation a vesicle or small blister appeared on the finger. This became broken, and several others formed on the back of the hand. The whole hand and the fingers became swollen and inflamed, the inflammation extending in broad lines as far as the elbow. The general disturbance lasted a fortnight.

sive lochial discharge, it is apt to appear within the first fortnight after the calving.

Dealt with in greater detail, the phenomena of the disease appear to be as follows:—

Fever.—At the commencement of the illness the cow is somewhat feverish, the nose is brown and dry, the coat is rough and staring. This fever may last, in severe cases, from seven to eight days; in slighter cases, from three or four days to a week.

Two or three days after the commencement of the fever, the skin around the eyes, in cases of severe attack of the malady, becomes puffy and swollen, and in another two or three days, *i.e.*, about the fourth to sixth day of the fever, a minute red rash, about the size of pin-heads, and slightly raised above the level of the skin, appears upon the skin around the eye-balls. The cuticle on this part usually peels off about three or four weeks after the rash appears, leaving the skin hereabouts devoid of hair.

Discharge from the Eyes and Nose.—About the time that the rash appears on the skin surrounding the eyes, a yellow mattery discharge comes from under the eye-lids, and collects in the inner corner of the eye. This discharge is, in particular cases, sometimes so severe that it is necessary to cleanse it away with a sponge. In severe cases, too, the discharge may continue for some time, and is believed to be contagious. A nasal discharge of a similar nature is apt to appear about the same time, and is believed, also, to be contagious.

Cough.—A dry, husky, hacking, irritative cough, with bronchial *râles* and quickened breathing, frequently comes on with the initiatory fever. The cough may last, more or less, as long as the cow is ill, and the quickened breathing may continue for a fortnight, or longer in some cases.

Sore-throat.—Sore-throat is stated to occur in severe cases, especially in newly-calved cows, attended with puffiness and swelling under the jaw. It comes on with the irritative cough, and is, in some cases, so bad that the cow has to be fed with gruel. In slighter cases the sore-throat has not been particularly noticed, and may or may not have been present.

Bowels and Urine.—In very acute cases the bowels are inclined to be loose. The urine is sometimes scanty and high-coloured, and the cow loath to pass it.

Teats and Udder.—From five to seven days, more or less, after the commencement of the illness, one or more teats become enlarged, swollen to nearly double the natural size, and slightly œdematous.

On fingering the teat there is no feeling of induration or hardness. Vesicles or bullæ next appear upon the swollen teats, and upon the udder between or near the teats. In number they range from two to four on a teat, varying in size from a pea to a horse-bean, and containing at first a clear fluid. The first vesicle frequently appears between the two fore-teats, close to the abdominal vein, and is usually as large as a good-sized horse-bean. This vesicle is not preceded by a hardened papule as in cow-pox, but is in the first instance a vesicle or bulla. These vesicles usually become rubbed and broken in milking, leaving raw sores, sometimes red, in other cases pale in colour, with raised ulcerated-looking edges. Sometimes a few smaller accessory vesicles are formed around the margin of these ulcerated sores. The lymph from these vesicles in this stage can seemingly be conveyed by the hands of the cow-man to healthy cows, and so propagate the disease by direct inoculation of their teats. Shortly after the vesicle has been broken, a brown scab forms upon the sore. These scabs may remain attached for five or six weeks, or may fall off in ten days or a fortnight, a smaller one forming afterwards. A thin, watery fluid exudes from under the scab, and the sore ultimately heals under it.

I examined the teats of several cows five or six weeks after they were attacked. The scabs then varied in size from a shilling to a florin; they were about one-eighth of an inch thick in the centre, thinning off towards the edges. On picking off some of these, the recently healed skin was of a pearly-blue colour, with a slight tendency to bleed when the scab was forcibly detached; but there was no depression or pitting of the skin. After the vesicle had become broken and the scab formed, the swelling of the teat gradually subsided.

Difference between Cow-pox, Chapped Teats, and these Vesicles.—As, in the course of our inquiry, it was strongly asserted by several people who examined the cows, that they were suffering from cow-pox, it is worth noting some of the differences between cow-pox and this disease. Both appear on the cow's teats and on the udder, at or near the bases of the teats, but in *cow-pox* a hardened *pimple* first appears, and this pimple becomes a vesicle, which, if it remains unbroken by the hands of the cow-man, develops into a globular or oval acuminated *pustule*. A central depression forms in the pustule, with raised, pearly-looking edges, with hardening round the margin, and with a distinct areola. In the *cow-disease now in question*, there is no hard pimple preceding the vesicle; there is no formation of pustule; there is no cen-

tral depression of the vesicle, no marginal induration, no areola, and when the scabs fall off there is no pitting of the skin.—It deserves mention that some persons who examined the cows affirmed that the sores on the teats were of the nature of *chaps*, caused by exposure to cold winds when the teats were moist. This was an altogether unsatisfactory explanation, because, although some of the animals stood opposite the doors (which were usually shut), many others affected with the same disease were not so exposed; and, moreover, the chapped teats, resulting from exposure to cold winds, commonly bleed in milking. These sores do not bleed in milking, unless when very roughly used.

Skin Eruption.—I have already mentioned that one of the early symptoms of the disease is puffing of the skin around the eye-balls, with a minute red eruption or rash upon it about the size of pin-heads. This was insisted on in an account given me by a competent and seemingly very accurate observer. But besides this rash an eruption appears upon the top of the hind-quarter, on one or both sides, extending, in some cases, down the outside of the leg as far as the hock, in others to the fetlock joint. I am inclined to think that the first stage of this eruption appears about the same time as the first appearance of the vesicles upon the teats; but, on account of the difficulty of seeing it upon a cow's skin, it is impossible to say so with absolute certainty. It was most difficult to find amongst the cow's hair any eruptive spots in the first stage, but on careful searching one was found upon the skin of the cow which we supposed to be in that stage. The spot was circular, about the size of a split-pea, red, not raised above the level of the skin, but with a slightly thickened base. About fourteen days after the commencement of the illness this eruption on the hind-quarters has arrived at its scabbing stage, and the severity of the eruption has appeared to correspond, to some extent, with the severity of the attack, and the number of vesicles upon the teats and udder. In cows whose teats and udder showed numerous vesicles, the eruptive spots were plentiful and close together; in cases where the vesicles were few in number, and the animal evidently suffering from a slight attack of the disease, the eruption was not so well marked, but showed more in isolated spots, ranging in size from a split-pea to a shilling. This eruption was confined entirely to the rump and outside of the hind-quarter, there being none under the tail, on the back, or behind the ears. The skin-eruption in its later stages consisted of patches of eczematous-looking crusts. When a crust was picked off, the hair came off with it, exposing a raw, moist

sore, the crusts and the sores looking exactly like eczematous scabs and sores. In some cases, where the scab had been forcibly detached when newly formed, the sore looked bloody. In more advanced cases, the scab, when picked off, showed the skin healed under it, but devoid of hair. There was no pitting of the skin.

The Milk.—In a specific disease affecting the constitution of the cow shortly after calving, it might be expected that the milk, being an animal secretion, would be in some way affected by the disease. Specific virus circulating in the cow's blood is obviously likely to contaminate the milk produced by her, and through this medium to convey the disease to human beings. Early in the disease, the milk of cows suffering in this way, if set aside for some hours, as matter of fact is apt to become ropy, or, as I have heard it described, "ropy, slimy, or as thick as a pudding". This condition of the milk may occur, it is said, even before the vesicles appear upon the teats and udder, or the eruption on the hind-quarters. It shows itself in milk that may have been set aside for from six to twelve hours for the cream to rise, and it ought to be looked for in all suspicious cases of cow-illness. In some cases, when the cow is being milked, the first few "draughts" of the teat may bring thick or knotty milk, but afterwards there is nothing abnormal to be seen in it. In many cases there is nothing particular discernible about the milk as it comes from the cow; it flows freely, and looks exactly like ordinary milk. As the milk from this dairy-farm was sent direct from the farm to the milk-shop, and immediately distributed to the customers, this peculiarity would not have had time to show itself; and, further, as the cream is now usually removed by "separators", this milk would not, in all probability, have been set aside for the cream to rise. In cases where, at a dairy farm, only one or two cows are suffering from a mild attack of the disease, this ropiness might not show itself if the milk was mixed with a quantity of milk from healthy cows, although this mixed milk might very well be capable of injuriously affecting those who consumed it.

I believe that this ropiness of milk appears in several cow-diseases. Its precise nature, and the causes which give rise to it, require careful investigation. It was particularly noticed, and described to me by several persons, as having been observed by them about three years ago, in milk supplied from another dairy-farm in this district a few days before a severe outbreak of diphtheria among consumers of the milk. This ropiness of the implicated milk was the subject of much discussion at the time, and was attributed by the farmer to

feeding the cows on too much clover hay. He admitted the fact of the ropiness of the milk, and took, he said, milk from each individual cow, to see, if possible, which animal gave ropy milk; but he did not set the milk aside to stand awhile, and so failed to detect the culprit. Unfortunately, in this instance, several of the cows were removed and killed, before there was a chance of examining them, and so an opportunity of gaining, perhaps, important information was lost. This outbreak was the subject of special inquiry by Mr. Power. The cause of the diphtheria was clearly traced to the farm, and the ropy milk was so clearly described and admitted as to give rise to suspicion that there was some disease of the cows causing it. This disease, for the reason stated, we failed to discover.

I am not assuming that this cow-malady under discussion is capable of causing in the human subject any other disease than scarlet-fever, but I regard it as helping to throw some light upon the natural history of diphtheria; indeed, there may be a yet undiscovered cow-disease, perhaps without much skin eruption, and without conspicuous disease of the teats or udder, and probably also of a trivial nature in the cow, but with symptoms somewhat different from those of diphtheria in man, which is capable of causing this disease in human beings through the medium of the milk from such cows. At the same time it is possible that diphtheria *may* be caused by some modification of this particular malady; but this can only be settled by future careful observation and experiment.

I will not here make any statement regarding the information I have been able to obtain as to the visceral lesions of this disease, as they will have come under Dr. Klein's observation, and will, no doubt, be described by him.

Our knowledge of the cow-disease I have been dealing with being still in its infancy, the description above given of its signs and symptoms may, as I have said, require modification, alteration, or amendment, with more extended inquiry and fuller knowledge of the subject.

My object has been to lay before you as fully as possible what I have been able to observe and glean of the matter, in the hope that it may assist farmers, dairymen, and milk-producers generally to detect, as early as possible, the presence of this disease amongst their herds, and so enable them to take proper measures for the isolation of the infected animals, and the withdrawal of the infected milk from public consumption. This is a matter of great importance to them, as this malady might invade their stock any day, with the result of causing

them absolute ruin. The unfortunate farmer in whose herd this disease has recently occurred must have lost upwards of £1,000 by the loss of milk and depreciation in the value of his stock.

Further, it is a matter of the utmost importance to the general public, who are liable to receive, at any time, milk having ability to cause disease and death in their families, for in the present state of affairs *they have no protection whatever* against such accident.

In view of these considerations, it appears to me that precautions of the following nature ought to be taken by farmers and cowkeepers.

1st.—That all newly-calved cows which suffer from any undue constitutional disturbance after calving, should be at once removed from the milk-business until completely restored to health.

2ndly.—That any cow developing symptoms such as I have described, should be at once removed to an isolated shed; should be attended to by some one who has nothing whatever to do with the other cows; should have her skin carefully cleansed and, if necessary, washed with a disinfectant, and her teats and udder also washed with carbolic acid lotion, or other disinfecting agent.

3rdly.—The cow-shed, after her recovery, should be thoroughly cleansed and disinfected, and the cow should not be again placed in the milk-business until her health is completely restored.

Finally, I cannot but think that the history of this outbreak points to urgent necessity for the systematic and careful inspection of all farms supplying the public with milk, by men thoroughly conversant with cow-diseases, and having special knowledge of such as may possibly be transmitted along with milk to human beings. At present there is great room for improvement in the knowledge of these cow-diseases amongst farmers and cowkeepers, and it is to be hoped that Government will see fit, before long, to institute some means of more effectually protecting the general public against the recurrence of these disastrous outbreaks of disease which are due to milk.

ON CERTAIN SUPPOSED INJURIES BY VACCINATION IN NORTH GERMANY IN 1885.

By GEORGE BUCHANAN, M.D., F.R.S.

(*Read: May 12th*, 1886.)

THE story, as told in the official publications of the Berlin Sanitary Department, is of 342 persons affected by a disease having the clinical characters of impetigo, communicable from person to person, occurring last summer in villages situated in the Island of Rügen, in the Baltic, after the vaccination of 79 children in the latter part of June. A Medical Commission appointed by the German Minister of Public Health appear to have been quite satisfied that the disease did not exist in the villages before June. They make the statement with confidence, but do not seem to have examined the dates of its commencement in those individuals whom, in August, they found suffering; and they tell of villages invaded subsequently to June, for which no vaccinations had been done, but into which infected persons had conveyed the disease. There would appear no doubt, however, that children vaccinated with a certain sort of "lymph", suffered from it in largest proportion (75 out of 79 primarily vaccinated with it), probably, too, earlier than most other sufferers. All these vaccinations had been done by Dr. Ebert at two stations, to each of which children from several villages had been brought. Some children were at the same time vaccinated with other lymph, but their number is not stated. At each station all the primary vaccinations were done on a single occasion; all the revaccinations on another occasion, namely, on the day-week following the primary vaccinations. Evidence respecting any presence of the eruptive disease in the waiting-rooms of the stations is altogether lacking; but such disease was not *known* to have existed among the people coming with their children for vaccination.

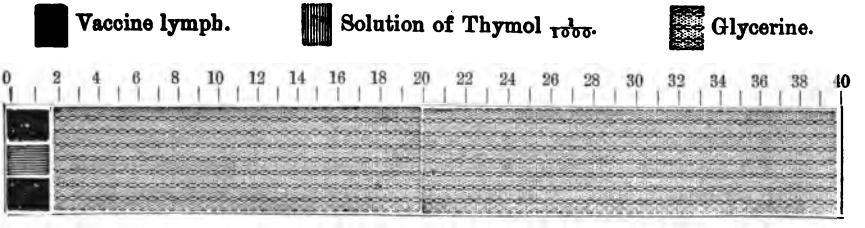
The primary "vaccinations" (I shall presently have to object to the word, but I use it here for the sake of brevity) done with the "lymph" in question, were, in the great majority of cases, followed by insignificant vesicles; at one of the stations two children only were found to yield lymph

for the after revaccinations. Those two children, having the best vaccine vesicles, and the school children revaccinated from them, did not suffer from the eruptive disease.

The material that I have spoken of as "lymph", furnished to Dr. Ebert, with which the vaccinations were performed, was a mixture of lymph with a solution of thymol, and as such it was obtained from the Government establishment at Stettin. The lymph itself was taken from two healthy children, who remained well. Twenty-seven tubes of it were taken from the two children; not distinguished the one from the other. After its admixture with thymol solution it was used by twelve other practitioners in various localities, and in the hands of seven produced ordinary regular results. In the hands of the remaining five it produced regular results on thirteen children; irregular results on sixteen. The irregularity had consisted in eleven cases of sores after the vaccination; in one case, of slight erysipelas; and in the remaining four cases of some skin-eruption, apparently comparable to that in the Rügen villages. In one of the villages, the same skin-disease was prevalent at the time among persons not under vaccination. One of these experiences had a certain significance. Two tubes had been sent to the operator: one, used in the vaccination of three children, gave regular vesicles; the other, used to other three, gave sore arms.

To revert to Rügen. The lymph and thymol mixture was a month old when it was used. As two tubes of it were not enough for the vaccination of seventy-nine children, it was further mixed with glycerine (*glycerinum purissimum*) before use. On our English scale of using one tube for the vaccination of two children, this dilution would have required about 1,900 parts glycerine to be added to every 100 parts of the lymph-thymol mixture; or if we may reckon four children vaccinable from a tube, the dilution would have to be at the rate of about 900 per cent. I hand round a plan showing quantitatively the components of the stuff used by Dr. Ebert in his Rügen "vaccinations". You will not wonder that I object to the term.

[Let us assume (from English practice) that one tube full of lymph suffices for the vaccination of two children, but no more. Then to obtain sufficient stuff for the so-called vaccination of seventy-nine children, the contents of two tubes need to be extended so as to equal the contents of 39.5 tubes; this was done with "glycerine". But the contents of the two tubes were not entirely lymph; they were made up of two parts lymph and one part "thymol-solution". Wherefore the following is a diagram of the composition of the stuff with which Dr. Ebert "vaccinated" his seventy-nine children.



Or, if a tube full of lymph be thought of as sufficing for four vaccinations, the required dilution with glycerine would be to the place marked 20.]

Other children, it is reported, vaccinated in the same district of Rügen, about the same period, with lymph from other sources, did not suffer from the prevalent eruption. But there is such a deficiency of evidence about places and times, that the value of the statement is but small.

The English student of the reported facts, however much he may be interested in them as compromising a valuable operation, cannot regard himself as having concern with vaccine lymph until two preliminary considerations have been taken into account, and disposed of.

(A) For, probably, the simplest explanation of the eruption, as recorded, would be that an *impetigo contagiosa* (it is by this name that one of the Commission calls the disease) was in existence in the Island of Rügen last June, and was so far prevalent that at two vaccinating stations it could be distributed pretty simultaneously to groups of children and parents frequenting the station, and afterwards by them to other people. Such an impetigo contagiosa reads very much like a synonym for *pustular itch*, which we know may at times be found unrecognised in many English villages of a Poor-law Union; or it may have been a veritable contagious skin-disease of another sort, yet having no relations with vaccination. The difficulty in accepting this view lies in the fact of a skilled Commission not having recognised, in the local skin-affection, the characters of diseases so well-known as *itch* and common *impetigo*.—In the absence of exact evidence on the subject, I am not disposed to take the bald statement, that skin-disease did not exist in Rügen last June, as constituting any great obstacle to the acceptance of this view.

(B) Another explanation that calls for consideration and exclusion before vaccine lymph as such is taken into notice, is that, in the material which was inserted into children's

arms, under pretence of vaccination, there was something or other capable of producing the result in them, and from them by infection to non-vaccinated persons. The principal misgivings of the Commission on this subject had concern with the glycerine; and certainly there was more glycerine than anything else used in the "vaccinations". Several points in the circumstantial evidence, however, suggest to me that the Stettin mixture before glycerine had been added, may have been responsible for some irritative result. The mixture was probably *unevenly* made, inasmuch as some tubes filled with lymph from the same source, nominally mixed with the same thymol solution, produced nothing but regular vesicles, while other tubes sent out in pairs gave (in the hands of five different practitioners) some normal and some abnormal results, and one practitioner definitely connected the normal with the one tube, the abnormal with the other. In the Stettin experience, such lymph as produced the best vaccine vesicles did not produce skin-disease. Let it be observed that *unevenness* of mixture is strongly suggestive of something more serious, namely, of haphazard processes, in the course of which unrecognised matters, that would be more mischievous than thymol or glycerine, were liable to get included. The observed differences among the results of inoculation with these tube-contents were very probably parallel to differences of the sort here suggested as existing among the tube contents; and the parallelism appears to me indicative of the fault (supposing the inoculated materials to have been responsible for any part of the resulting epidemic) having lain in some or other of the foreign substances mixed with the lymph as put into the tubes at Stettin. The point, however, is not considered in the Report of the Commission.

I do not know of any experience in England of inoculation with thymol or thymol and glycerine; but I have heard of dilutions of lymph with glycerine, always from people complaining of the lymph. I know also of foreign substances carelessly introduced during the operation of vaccination, and productive of abnormal results. I think it probable that a few experimental inoculations, if they could have been made with the total of various foreign substances in question under various conditions of admixture and of keeping, and in the absence of all vaccine lymph whatever, would have been found to give instructive results. No such experiments were made.

Of the *vaccine lymph* itself, as included in the tubes, we have no differential statement. It was all mixed, or meant to be mixed, with thymol solution; and all we know of it is that,

where it contrived to exhibit its own properties most completely, there was no accompanying disease of the skin.

Altogether the investigation of the Commission was much too rapid, and was very unsatisfactorily conducted. The conclusions of the Commission, as reported, are largely concerned with questions of nomenclature and means of preventing the spread of the current disease. It will, I trust, be long before such preposterous adulterations of vaccine give the opportunity of investigating their results in English practice.

To sum up, there is nothing in the report of the Commission which forbids us to regard the epidemic as a communicable skin disease, commencing to be prevalent last June in the villages of a district in Rügen, but not obtaining extensive prevalence until after the June vaccination period. At that period, people had congregated at vaccination stations in two villages; and within two months afterwards, 342 persons, almost exclusively children, were attacked by the prevalent disease. It affected seventy-five out of seventy-nine children, recorded as having been "vaccinated": that is, who had been inoculated with a mixture of glycerine, vaccine lymph, thymol, and perhaps other unrecognised matter. In the absence of dates and other information there is little to connect the prevalent disease with the operation that pretended to be vaccination. Throughout there is absolutely nothing to connect it with the vaccine lymph as derived in the preceding May from children at Stettin.

HYDROPHOBIA STATISTICS.

By G. B. LONGSTAFF, M.B.

(*Read: May 12th*, 1886.)

It is, I take it, an especial object of this Society to take a general view of the phenomena of the prevalence of epidemic diseases, or diseases supposed to be epidemic in their nature, whereby facts may be brought to light that might escape the clinical observer; just as the geologist ascertains one set of facts by going into a quarry and examining the face of the rock, but ascertains another, scarcely less important, set of facts by observing the general contour of the hills as seen from the other side of the valley.

The unprecedented number of deaths from hydrophobia in London during the year 1885, and the prominence given to the outbreak by the Police Order, as well as the great interest excited by M. Pasteur's researches, point to the present as a suitable time to search the official records of this country, and review the facts therein buried.

The arrangement of the Registrar-General's reports makes it convenient to consider separately the prevalence of hydrophobia in England and Wales generally, and in the Metropolis. The figures for the latter supply several facts not recorded for the whole country; moreover, it will be noted in the Tables that the periods covered are not the same in all cases.

England and Wales. — During the thirty-eight years 1847-84 inclusive, no fewer than 884 persons are stated to have died from hydrophobia. (See Table I.) The deaths were very unequally distributed throughout the period; thus, in 1862 there was only one death registered from this cause in the whole country, whereas in 1871 there were 56, in 1874 as many as 61, and in 1877 no fewer than 79. The number rose from 5 in 1847 to 25 in 1851, and then fell gradually to 5 in 1856. During the eight years 1856-63 only 26 deaths occurred, or an average of 3 per annum. The figures then rose to 36 in 1866, fell to 7 in 1868, and rose again to 56 in 1871, from which time they have fluctuated from a minimum of 28 (in 1873, 1882 and 1884) to a maximum

of 79 (in 1877), making an average since 1870 of 43 deaths per annum.

If the whole time be divided into four periods of ten years each, it will be seen that the mortality from hydrophobia has increased considerably, both absolutely and relatively, in the more recent years. In the second period the number of deaths was less than half that in the first, but in the third and fourth periods, even after allowing for increase of population, it was double that in the first period, and five times that in the second period.

TABLE I.

Deaths from Hydrophobia in England and Wales and in London.—Forty years, 1846-1885.

I.	England and Wales.	London.	II.	England and Wales.	London.	III.	England and Wales.	London.	IV.	England and Wales.	London.
1846	*	1	1856	5	...	1866	36	11	1876	53	6
1847	5	...	1857	3	2	1867	10	3	1877	79	16
1848	7	1	1858	2	...	1868	7	...	1878	50	5
1849	17	...	1859	4	...	1869	18	3	1879	35	2
1850	13	1	1860	3	...	1870	32	...	1880	29	3
1851	25	...	1861	4	...	1871	56	1	1881	34	5
1852	15	...	1862	1	...	1872	39	...	1882	28	4
1853	11	1	1863	4	2	1873	28	1	1883	34	8
1854	16	7	1864	12	...	1874	61	9	1884	28	9
1855	14	2	1865	19	9	1875	47	6	1885	†	27
Total...	123	13	Total ...	57	13	Total ...	334	34	Total ...	370	85
Mean ..	13.7	1.3	Mean ...	5.7	1.3	Mean ...	33.4	3.4	Mean ...	41.1	8.5
Rate per million	.76	.55	Rate per million	.28	.46	Rate per million	1.47	1.04	Rate per million	1.59	2.23

		Total Deaths.		Mean.		Rate per Million.
England and Wales	38 years	884	...	23.3	...	1.03
London	40 years	145	...	3.6	...	1.07

Of the total deaths from hydrophobia in England and Wales during the thirty-eight years for which the returns are given in Table I, being 884 in number, no less than 413, or nearly half, occurred in the eight years 1871-78, during which period the death-rate from this disease averaged 2.15 per million persons living.

* No returns of "Causes of Death" in this year, except for London.
† Returns for England and Wales not yet published.

London.—As regards the metropolis the figures are available from 1845 to 1885 inclusive, a period of forty-one years, during which 147 deaths were attributed to this disease, or an average of 3½ deaths per annum. (See Table I.) In fourteen of the years no death occurred: indeed, there was complete immunity for the five years 1858-62; but, on the other hand, in 1866 there were 11 deaths, in 1877 as many as 16, and in 1885 no less than 27.

Taking periods of ten years, as was done with the figures for England and Wales, similar results are obtained, but the correspondence is only general. Thus, the increase of the fourth period when compared with the third is much more marked in the case of London. Again, while 1877 and 1874 were periods of high mortality, both in the whole country and in London, on the other hand the greatest mortality in England and Wales during the first nineteen years in the Table was in 1851, when there were 25 deaths registered, but there were none in the metropolis that year. There are also marked discrepancies in 1854, 1865, 1866, and 1871.

There seems to be no doubt that the disease is getting commoner in London, and the figure of last year—27—has not been approached before, so far at least as our records go. During the first seventeen weeks of 1886 as many as six deaths have been registered, as against four during the corresponding period of last year.

Taking the three periods covered by the decennial reports, and taking the mean populations given in these reports, we get the following average annual death-rates per million living.

	England and Wales.		London.	
	Deaths.	Rates.	Deaths.	Rates.
1851–1860 ...	98 ...	0.52 ...	12 ...	0.46
1861–1870 ...	143 ...	0.67 ...	28 ...	0.92
1871–1880 ...	477 ...	1.96 ...	49 ...	1.39
Total ...	718 ...	... ...	89	

The Table shows that, relatively as well as absolutely, the disease is, both in London and the country, as a whole much more fatal now than it was formerly—some threefold.

Seasonal Prevalence.—The data for determining the seasonal prevalence of hydrophobia are only available for the metropolis. In Table II the 147 deaths that have been attributed to hydrophobia in London during the forty-one years 1845-1885 are arranged according to the weeks in which they were registered. The weekly average for each month is also given. It will be noticed, as might have been expected, that in

several weeks (seven) no death has occurred, whereas in two weeks—the third in July and the last in September—no less than nine deaths have been registered. As regards months, the weekly average is lowest in March and February; rises gradually to a maximum in September; falls in October; rises to a second maximum in November, then falls rapidly to February. Happily, the disease is too rare to allow of any positive conclusions being drawn as to the way and extent in which it is influenced by meteorological conditions. The figures given in the Table show that it is by no means confined to the "dog-days", though certainly deaths from hydrophobia are most frequent at about that time of the year.

TABLE II.

Hydrophobia in London.—The weeks in which 147 *deaths were registered during the forty-one years*, 1845–1885.

		Weekly Mean.			Weekly Mean.			Weekly Mean.			Weekly Mean.
1st	2		14th	1		27th	3		40th	3	
2nd		Jan.	15th	3	April	28th		July	41st	3	Oct.
3rd		2.50	16th	2	2.00	29th	9	3.75	42nd	4	2.75
4th	8		17th	2		30th	3		43rd	1	
5th	2		18th	1		31st	5		44th	7	
6th		Feb.	19th	1	May	32nd	6	Aug.	45th	3	Nov.
7th		1.25	20th	1	1.75	33rd	3	3.75	46th	2	4.50
8th	3		21st	4		34th	1		47th	6	
9th	2		22nd	2		35th	3		48th	1	
10th		March	23rd	2	June	36th	2	Sept.	49th	5	Dec.
11th	2	1.20	24th	7	2.80	37th	4	4.80	50th	5	2.80
12th			25th	1		38th	6		51st	2	
13th	2		26th	2		39th	9		52nd	1	
1st Qr.	21		2nd Qr.	29		3rd Qr.	54		4th Qr.	43	

The exciting cause of hydrophobia is undoubtedly inoculation with the poison of rabies, and the manifestations of the symptoms are delayed by a period of incubation, usually ranging from four to twelve weeks. It should, nevertheless, be borne in mind that conceivably meteorological conditions may influence hydrophobia in several ways,—*e.g.*, (1) it may directly or indirectly favour the spread of rabies in the lower animals; (2) it may render human beings bitten by rabid animals more or less susceptible to inoculation; (3) it may hasten or retard the time of incubation. Anyway, the fact remains, that although from the small number of facts available it is not possible to draw a regular curve for hydrophobia, the curve, such as it is, shows considerable fluctuations from the mean.

It may not be possible to say exactly in what way season affects hydrophobia, but it is pretty evident that in some direct or indirect manner the high temperature of summer has a decided influence in favouring it. This influence, as measured by the curve, is stronger than is observed in the case of scarlatina and enteric fever, but very much less marked than that of summer heat on diarrhœa.

Rabies.—The inquiry that naturally suggests itself is, what is definitely known about the seasonal prevalence of rabies in the lower animals? It is, unfortunately, not possible to get any complete or extensive statistics of the prevalence of rabies among dogs in this country. But I am able to lay a few figures before you this evening which, scanty and imperfect as they are, possess considerable interest.

Through the kindness of Mr. Ernest Batt, Veterinary Surgeon, and Mr. Victor Horsley, Professor Superintendent, I am able to give the numbers of admissions for rabies to the Brown Institution during the past six years, and the months in which they occurred.

TABLE III.

Brown Institution.—Admission for Rabies.

	1880.	1881.	1882.	1883.	1884.	1885.	Total, 6 Years.
January ...	...	...	...	1	...	...	1
February ...	...	1	...	1	...	1	3
March	..	1	3	2	...	1	7
April	...	1	1	...	2	...	4
May	..	...	1	2	1	2	6
June	...	1	...	...	...	1	2
July	.	...	...	...	...	1	1
August	1	...	...	1	...	...	2
September ...	...	1	1	...	2	3	7
October ...	...	...	1	1	3	2	7
November ...	...	1	1	1	7	6	16
December ...	...	...	2	...	3	...	5
Year	1	6	10	9	18	17	61

These figures show, first, a considerable increase of rabies in the last two years; secondly, that rabies, so far as the small numbers admit of any inference, is least prevalent in the summer months, but is a disease of autumn and spring.

Mr. J. C. Colam, the secretary to the Home for Lost and Starving Dogs at Battersea, has been good enough to supply me with the number of cases of rabies detected there in each month of the last three years by Mr. Sewell, the veterinary surgeon to that establishment.

These figures (Table IV) show little difference in the totals for 1883 and 1884, but a very great increase for 1885. There is no clear indication of influence of season.

The Police Order came into force on Nov. 20th, and it is remarkable that, with the exception of one case on Nov. 22nd, no rabid dog was admitted into the Brown Institution till the end of January, and that was the case of a dog that was believed to have contracted the disease outside the metropolitan area. At the Dogs' Home at Battersea the case was very different, for ten cases were detected in Dec. 1885 in that institution, being the largest number that had occurred

TABLE IV.

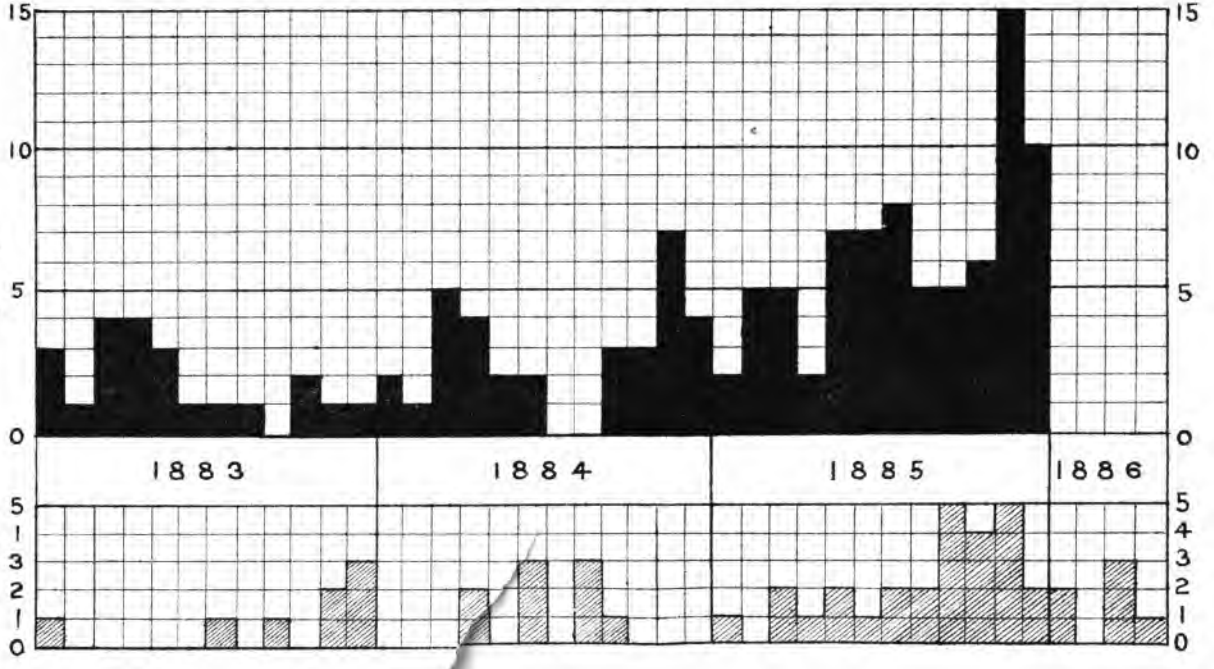
Temporary Home for Lost and Starving Dogs, Battersea. Admissions for Rabies.

	1883.	1884.	1885.	Total, 3 years.
January ...	2	2	2	6
February ...	...	1	4	5
March	2	5	4	11
April	4	2	2	8
May	1	1	5	7
June	1	2	6	9
July	1	...	7	8
August	...	...	5	5
September ...	...	1	2	3
October... ...	1	...	4	5
November ...	...	...	9	9
December ...	1	1	10	12
Year	13	15	60	88

in any one month. The discrepancy is explicable if we remember that the Police Order, while it cleared the streets, filled the Home to overflowing. The total number of dogs brought in was, in 1883, 14,647; 1884, 14,772; 1885, 25,578. Mr. Colam attributes the extra 10,000 dogs admitted in the last year entirely to the Police Order. The Brown Institution figures give low mortalities for January, June, July, and August: maxima in March and November. The Dogs' Home figures give low mortalities for January, February, August, September, and October; the maxima being in March and December. It would appear, then, that if influenced by the heat of summer, hydrophobia follows it like scarlatina, rather than accompanies it like diarrhœa. Rabies is least fatal to dogs in the summer, contrary to common report.

In Table V are shown, month by month for the last three

RABIES AND HYDROPHOBIA IN LONDON 1883 — 1885



years, the cases of rabies in the two institutions, compared with the deaths from hydrophobia registered in London. The same facts are shown more clearly in the diagram. The unusual number of cases of rabies in the Dogs' Home in November and December 1885, may well have been largely due to the enormous number of dogs swept into the Home by the Police Order, and so brought under the notice of the surgeon (Mr. Sewell). Making allowance for this, it will be seen that the outbreaks of hydrophobia follow those of rabies, after an interval of from three to six months, which is con-

TABLE V.

Monthly cases of Rabies at Brown Institution and Home for Lost Dogs, compared with deaths from Hydrophobia in London.—Three years, 1883-1885.

	1883.		1884.		1885.		Total, 3 years.	
	Rabies.	Hydrophobia.	Rabies.	Hydrophobia.	Rabies.	Hydrophobia.	Rabies.	Hydrophobia.
January... ...	3	1	2	...	2	1	7	2
February ...	1	...	1	...	5	...	7	...
March	4	...	5	...	5	2	14	2
April	4	...	4	2	2	1	10	3
May	3	...	2	...	7	2	12	2
June	1	...	2	3	7	1	10	4
July	1	1	...	...	8	2	9	3
August	1	...	...	3	5	2	6	5
September ...	...	1	3	1	5	5	8	7
October... ...	2	...	3	...	6	4	11	4
November ...	1	2	7	...	15	5	23	7
December ...	1	3	4	..	10	2	15	5
Year	22	8	33	9	77	27	132	44

siderably longer than the average period of incubation; but the agreement is perhaps as close as could have been expected from such small numbers. As to the cause of rabies, or, rather, the influence of meteorological conditions on it, the fact that outbreaks have occurred both in spring and autumn makes it unlikely that either heat or cold has any direct influence on the disease. The winters of 1854-5, 1860-1, 1864-5, 1870-1, 1878-9, 1879-80, 1880-1, were all remarkably cold; in the year following these hard winters there was a notable increase of hydrophobia in one case only, namely, 1871, in which 56 cases were recorded, as against 32 in the previous year. On the other hand, the summers of

1857, 1859, 1865, 1868, and 1884 were remarkably hot. In 1865 the cases of hydrophobia were 19 as against 12 in the previous year, but they increased to 36 in the year following. In 1868 there were but seven deaths, increasing to 18 in 1869, 32 in 1870, and 56 in 1871. In 1885 we know that in London there was a great increase of hydrophobia, but the returns for England and Wales are not yet available. In 1868 the fatality of summer diarrhœa reached its maximum, but the deaths from hydrophobia were fewer in that year than they had been for four years, and have never reached such a low figure since.

Age and Sex.—As regards age, the figures of the twenty-nine years 1855-83 are available. Of the total number of deaths during this period, viz., 747, more than three-fourths were of males and less than one-fourth females. But of these 747 deaths, 88 were of persons under five years of age, the males being twice as numerous as the females; 225 were aged between 5 and 15 years, the males being nearly three times as numerous as the females; 408 were aged between 15 and 65 years, the male deaths at those ages being nearly five times as numerous as the female; over 65 years there were 29 deaths, the males being four times as numerous as the females. The exact figures are given in detail in the Table.

TABLE VI.

Ages and sexes of 747 *deaths from Hydrophobia in England and Wales during the twenty-nine years* 1855–1883.

	All Ages.	0.	1.	2.	3.	4.	Total under 5.	5.	10.	15.	20.	25.	35.	45.	55.	65.	75.	85.
Males ...	587	1	5	16	15	22	59	95	73	53	56	91	72	41	26	19	2	...
Females	160	1	3	7	7	11	29	34	23	8	7	14	9	17	14	4	1	...
Persons	747	2	8	23	22	33	88	129	96	61	63	105	81	58	40	23	3	...

It will be observed that two deaths occurred under the age of one year (a male and a female); three deaths occurred over the age of 75 (two males and one female); no death occurred in a person aged over 85 years. As it would entail considerable labour to calculate the death-rate at each age for each year, I have adopted the following method, which gives, I think, a sufficiently close approximation,—indeed, with such small figures to start with, it would be pedantic to attempt great accuracy.

I have added together the deaths at each age for the fifteen

years 1864-78, and calculated the rates at each age on the population ascertained at the census of 1871. That is to say, I have assumed the population at each age enumerated in 1871 to be the mean of the period comprising that year, and seven years preceding and following. Again, in like manner I have calculated the rates at each age for the five years 1879 to 1883 on the basis of the population enumerated in 1881, the middle year of the period. The two sets of rates thus obtained have been added together and divided by twenty, with the following result.

TABLE VII.

Ages and sexes of 707 *deaths from Hydrophobia in England and Wales during the twenty years* 1864-1883, *together with the rates per million living at each age.*

	All Ages.	0.	5.	10.	15.	20.	25.	35.	45.	55.	65.	75.	85.
Males, Deaths ..	556	55	90	72	49	53	85	71	40	23	17	1	...
„ Rate per million	2.4	1.7	3.2	2.9	2.2	2.7	2.6	2.8	2.1	1.7	2.5	0.4	...
Females, Deaths	151	26	34	23	8	7	11	9	16	12	4	1	...
„ Rate per million	0.6	0.8	1.2	0.9	0.4	0.3	0.3	0.3	0.8	0.9	0.5	0.3	...
Persons, Deaths	707	81	124	95	57	60	96	80	56	35	21	2	...
„ Rate per million	1.5	1.3	2.2	1.9	1.3	1.4	1.4	1.5	1 4	1.3	1.3	0.4	...

It would appear that the greatest relative as well as absolute mortality occurs between the ages of five and ten years, and next after this in the succeeding period of ten to fifteen years. The explanation of this may perhaps be, that of those bitten a greater number of children contract hydrophobia—there may be a greater predisposition at those ages. On the other hand, it should be borne in mind that young children are less completely clothed than adults, and their partially naked limbs are without protection against the saliva of the rabid dog; moreover, they are less able to defend themselves against attack, and to some extent the smallness of their limbs is a danger, the dog getting hold of a small limb more easily than a large one,—though perhaps this point is not so important as in the case of snake-bites.*

It is remarkable that at all ages, from one year to seventy-five, many more males than females die from hydrophobia.

* In the discussion which followed the reading of the paper, Dr. Hime suggested that the greater liability of children to hydrophobia might be due to the small bulk of their bodies in relation to the amount of poison inserted by the dog's bite.

Boys under five suffer twice as much as girls; boys from five to fifteen, between two and three times as much as girls; youths of from fifteen to twenty, five times as much as maidens of like age; while from twenty to forty-five, men suffer eight or nine times as much as women; but after forty-five the disparity is not so great, men of forty-five to seventy-five dying of the disease only about twice as often (relatively) as women.

At the extremes of life the conditions as to occupation and habits are similar; in middle life men are brought much more into contact with animals by their occupations, and on the whole are not so well protected by their clothes, —for it must be remembered that all authorities lay great stress on the efficacy of clothes in wiping the saliva from off the tooth of a rabid animal. In young children it might have been imagined that girls were less protected than boys, but the latter are of course more venturesome. Dr. Ogle informs me that boys die more from violence than girls, and that the difference, which can only be accounted for by their greater daring and general wildness, shows itself at a very early age.

There is, however, one further consideration in reference to the far greater incidence of hydrophobia on males than females. We know that many more persons are bitten by rabid dogs than ever develop hydrophobia. May it not be conjectured that there is actually a greater predisposition in males to develop the disease? Is the proportion of females bitten, but showing no after ill-effects, greater than that of males? This is an interesting point for future inquiry. It may be well to summarise the facts in a short Table.

TABLE VIIa.

Analysis of 747 deaths from Hydrophobia in England and Wales during the twenty-nine years 1855-1883.

	Males.	Females.	Total.
Children under 10 years	154	63	217
Persons aged 10, but under 55 years ...	386	78	464
Persons aged 55 years and upwards... ...	47	19	66
Total	587	160	747

At the Dogs' Home the rabid animals are distinguished according to sex, thus:

	Dogs.	Bitches.	Total.
1883 ...	10 ...	3 ...	13
1884 ...	12 ...	3 ...	15
1885 ...	54 ...	6 ...	60
Total ...	76 ...	12 ...	88

From this it would appear that six times as many dogs suffered from the disease as bitches. Unfortunately, no record is kept of the total number of dogs and bitches admitted, so that it is not possible to calculate their respective death-rates. Mr. Batt is, however, of opinion that dogs are more liable to the disease, and that the difference is not to be accounted for by a smaller number of bitches, nor by these being kept in greater seclusion than dogs. Prof. Coleman stated that when rabies finds its way into a kennel of fox-hounds the mad dogs bite the dogs but spare the bitches. Among 392 collected instances, 356 dogs were bitten and only 36 bitches.*

Hydrophobia is, in this country, in the vast majority of cases, communicated to man by rabid dogs; but of 246 cases that were registered in the five years 1876 to 1880, as many as seven were attributed to the bites of cats. On the continent of Europe hydrophobia is often due to the bites of rabid wolves,—a danger that we are happily exempt from in this country.

TABLE VIII.

Occupations of 117 *persons who died of Hydrophobia in England and Wales in the five years* 1876–80.

	Man.	Wife or Widow.	Son.	Daughter.	Total.
Labourer	15	1	14	3	33
Agricultural labourer	9	1	6	3	19
Blacksmith	5	...	1	1	7
Carpenter, joiner	4	...	3	3	10
Mason	1	1	2	3	7
Cotton operative	3	...	1	...	4
Publican, beerseller, potman ...	4	...	2	...	6
Groom, ostler, coachman ... / Livery-stable keeper	4	1	1	2	8
Farmer, farm-bailliff	2	...	2	1	5
Gardener	2	...	1	2	5
Gamekeeper	4	...	..	...	4
Carter	1	...	1	...	2
Drover	1	...	...	...	1
Shepherd	1	...	...	...	1
Letter carrier	1	...	...	...	1
Errand boy	1	...	...	...	1
Hawker ... / Costermonger	1	...	...	...	1
	1	...	...	...	1
Veterinary surgeon	1	...	...	...	1
	61	4	34	18	117

* Sir T. Watson, *Principles and Practice of Physic*, 5th edit., p. 614.

Occupations.—For the five years 1876-80, the Registrar-General published the occupations of 246 persons—194 males and 52 females—whose deaths were attributed to hydrophobia. But an analysis of the occupations does not give any very interesting results. These 246 persons are described as having 125 different occupations. I will only call attention to the cases of the following 117 persons, which have been selected, either owing to the fact of several persons of that occupation having suffered, or to the fact that there is something suggestive about the occupation itself. (Table VIII.)

Geographical Distribution.—The deaths from hydrophobia in England and Wales have been by no means equally distributed. Thus, taking the whole period for which the figures are available, viz., the thirty-two years 1852-83 inclusive, out of 789 there occurred in each registration county the following numbers.

TABLE IX

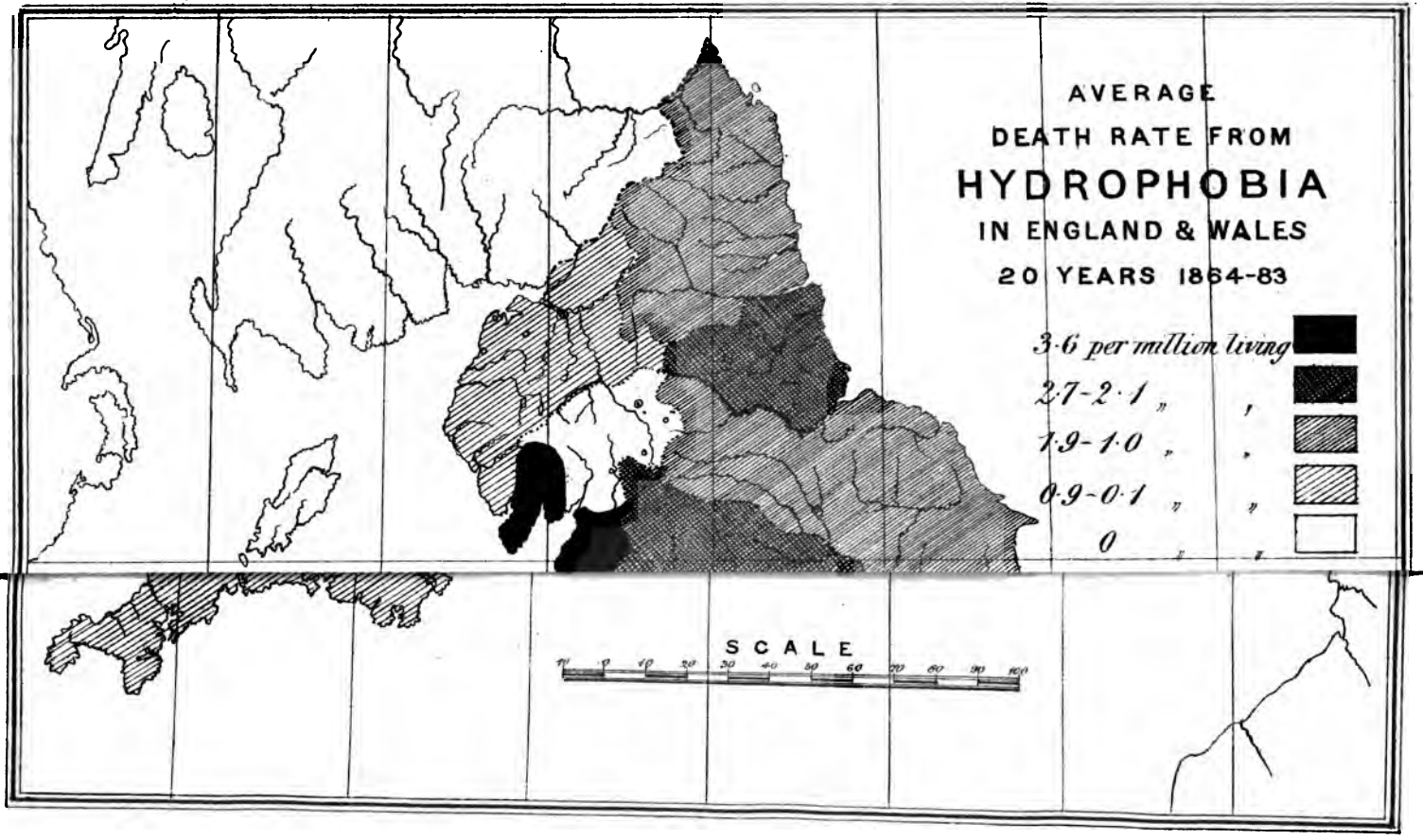
Geographical Distribution of 789 Deaths from Hydrophobia in 32 years, 1852–83.

Lancaster ...	225	East York ...	10	Gloucester ...	4
West York ...	100	Shropshire ...	9	Bedford	3
Metrop., Middlesex	71	Extra Met., Middlesex ...	9	Cornwall ...	3
Durham	34	Leicester and Rutland	9	Berks	3
Chester	33	Buckingham ...	8	Suffolk	3
Metrop., Surrey...	31	North York ...	8	Worcester ...	3
Stafford	29	Monmouth ...	8	Lincoln	3
Extra Met., Kent	18	Somerset ...	7	Dorset	2
South Wales ...	17	Devon	6	Metrop., Kent ...	2
Nottingham ...	17	Herts	5	Norfolk	2
Northumberland .	15	Wilts	5	Northants. ...	1
Extra Met., Surrey	15	Cantab.	5	Hereford ...	1
Derby	12	Oxon.	4	Huntingdon ...	0
Sussex	11	Cumberland ...	4	Westmoreland ...	0
Hants	10	North Wales ...	4		
Warwick... ...	10			Total ...	789
Essex	10				

Adopting the same method as before, the approximate death-rates in the various counties may be obtained for the twenty years 1864-83. (See Table X.)

The preference shown for Lancashire is seen to be very remarkable; Chester, Buckingham, and the West Riding of York coming next, but a long way behind. At the other extremity come the thinly populated counties of Northampton, Huntingdon, Hereford, and Westmoreland, in which an aggregate mean population of close upon half a million (498,223) kept quite free from hydrophobia for the twenty years under consideration.

It will be said that the population of many of the counties is too small to yield death-rates of any value from such a


AVERAGE
DEATH RATE FROM
HYDROPHOBIA
IN ENGLAND & WALES
20 YEARS 1864-83
3·6 per million living
2·7-2·1 " "
1·9-1·0 " "
0·9-0·1 " "
0 " "
SCALE

rare disease. There is less force in this objection than might be supposed. When the counties are coloured in a map with an intensity proportionate to the death-rates given in the Table, it will be seen that, with one or two exceptions, the patches of colour are grouped in a very definite manner. Thus the maximum mortality of Lancashire forms part of a patch of dark colour, including Cheshire, the West Riding, and Nottingham, while the home counties, with Cambridge, Oxford, and Buckingham, form another group of somewhat high mortality. The south-western counties and Wales form pale areas, connected, through Hereford, Gloucester, Warwick, Northampton, and Huntingdon, with Lincoln, Norfolk, and Suffolk. There is another pale area in the north: Durham suffers from an exceptional mortality. The slight exceptions of Wilts and Buckingham are of little importance, since the population of each of these counties is small, being under a quarter of a million, and the rates are based on five and eight deaths respectively.

TABLE X.

Hydrophobia, deaths, and death-rates per million in each county of England, and in North and South Wales.—20 *years*, 1864–1883, *comprising* 707 *deaths.*

Lancaster ...	214	3.6	Bedford	3	1.0
Chester	30	2.7	Hants	9	0.9
Buckingham ...	8	2.6	Somerset ...	7	0.7
West York ...	96	2.5	South Wales ...	10	0.6
Durham ...	29	2.1	Dorset	2	0.5
Nottingham ...	15	2.1	Devon	6	0.5
Metrop., Surrey ...	29	1.9	Cornwall ...	3	0.5
Northumberland ...	14	1.8	Cumberland ...	2	0.5
East York ...	10	1.6	North Wales ...	4	0.5
Derby	11	1.6	Berks	2	0.4
Extra Metrop., Surrey	12	1.5	Suffolk	3	0.4
Shropshire ...	8	1.5	Metrop., Kent ...	2	0.4
Stafford ...	26	1 5	Warwick ...	5	0.4
Extra Met., Middlesex	9	1.4	Worcester ...	2	0.3
Metrop., Middlesex ...	62	1.3	Gloucester ...	3	0.2
Leicester and Rutland	8	1.3	Norfolk	2	0.2
Hertford ...	5	1.3	Monmouth ...	2	0.2
Extra Met., Kent ...	15	1.2	Lincoln	1	0.1
Sussex	10	1.2	Northants. ...	0	0.0
Oxford	4	1.2	Huntingdon .		
North York ...	7	1.2	Hereford ...		
Cambridge ...	4	1.0	Westmoreland ...		
Wiltshire ...	5	1.0	England and Wales ...	707	1.5
Essex	9	1.0			

N.B.—Of the 214 deaths in Lancashire, some occurred in every year (save only 1867) of the period. But there was no death in that county in 1854, 1855, 1856, nor 1858–1862, inclusive.

The mortality from hydrophobia appears to be closely related to the density of the population, with the striking exception that London is comparatively exempt. Can this be explained by the efficacy of police regulations in the metropolis ?

In Table XI is shown the number of deaths from hydrophobia in each of the registration divisions of England and Wales for the thirty-four years 1850-83. These areas are not liable to the charge of being too small in population, since the smallest of them has more than one million of inhabitants. An examination of this Table would of itself be sufficient to prove, if such proof were needed, that the disease was a communicable one. Thus it is seen that for the first fifteen years not a death occurred in the south-western division; then a solitary death occurred in Devon. After this there was another interval of ten years, followed by a period of six years, during which the annual deaths varied from one to nine. Take as a contrast the north-western division. For the first four years there were annually from two to five deaths; then a blank year, followed by one death; another blank, followed by two deaths; then complete absence of the disease for five years, after which the disease, with the exception of 1868, was fatal every year, killing some years as few as two persons, but more usually 10, 12, up to 17, 19, and even 22 in the year.

The comparative immunity for a long series of years of isolated counties like Cornwall, suggests that more strenuous police measures against rabies, if carried out uniformly throughout the country, and for a sufficient length of time, would be successful in stamping out the disease.

Summary.—Briefly, the points to which I would call your attention are these:

1. Hydrophobia is stated to have killed 884 persons in England and Wales in the past thirty-eight years.
2. During the latter half of this time it has been about five times as fatal, relatively to the numbers living, as it was during the first half.
3. Nearly half the above number of deaths occurred during the eight years ending with 1878.
4. As a rule, London has not suffered so much as other parts of the kingdom.
5. Hydrophobia is most fatal towards the end of summer and throughout the autumn.
6. So far as has been ascertained, Rabies is most fatal in late autumn and in the spring, and least fatal in the summer.
7. Directly or indirectly, hydrophobia appears to be more

TABLE XI.

Deaths from Hydrophobia in the Registration Divisions of England and Wales in each of thirty-four years, 1852–1883.

Divisions.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	Total, 34 Years.
I.—London	1	1	.	...	9	2	...	...	...	...	...	...	...	...	...	9	11	3	...	3	...	1	1	1	9	6	6	16	5	2	3	5	4	8	106
II.—South-Eastern ...	...	2	...	...	1	5	...	1	1	1	...	...	...	...	2	...	2	...	1	...	...	...	...	...	5	1	7	12	6	2	...	2	6	2	59
III.—South Midland ...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	1	2	1	1	...	...	1	...	...	1	...	1	11	4	1	1	2	3	3	35
IV.—Eastern	..	1	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	1	1	2	2	2	...	...	...	1	3	16
V.—South-Western ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	3	9	2	4	1	2	...	1	23
VI.—West Midland ...	2	1	2	...	1	4	2	...	...	2	1	...	...	...	...	1	1	...	...	...	...	3	8	5	7	7	1	2	1	2	1	1	2	2	59
VII.—North Midland ...	1	3	3	1	1	...	...	...	...	..	1	...	...	...	...	...	1	1	...	..	4	5	4	1	4	4	1	1	1	...	2	1	...	5	45
VIII.—North Western ...	2	5	4	5	..	1	...	2	...	...	...	...	...	2	10	4	14	2	...	6	12	22	16	15	17	17	8	19	22	16	10	15	9	10	265
IX.—Yorkshire	2	3	...	1	2	...	1	...	1	...	...	...	...	...	...	...	...	...	5	7	10	16	6	2	15	10	14	1	5	7	6	6	3	...	123
X.—Northern	3	2	5	2	1	...	...	...	...	...	...	...	...	...	...	1	5	3	...	2	6	6	4	4	2	1	6	3	2	...	...	...	...	...	58
XI.—Monmouth and Wales ...	2	7	1	2	1	1	1	...	...	1	1	4	...	2	...	...	...	...	...	...	...	2	...	...	...	...	4	3	...	1	5	...	...	...	38
ENGLAND AND WALES ...	13	25	15	11	16	14	5	3	2	4	3	4	1	4	12	19	36	10	7	18	32	56	39	28	61	47	53	79	50	35	29	34	28	34	827
Divisions affected	7	9	5	5	7	6	4	2	2	3	3	1	1	2	2	7	7	5	3	4	4	8	6	6	9	8	11	11	10	8	8	8	7	8	
Counties affected	...	...	11	6	8	11	6	2	2	4	3	2	1	2	3	9	11	7	3	5	9	13	12	10	18	15	18	26	20	12	12	10	14	14	

influenced by season than scarlatina or enteric fever, but much less so than diarrhœa. Neither exceptionally hot summers nor cold winters appear to influence the disease.

8. The recent police order checked the spread of rabies, but brought a large number of cases into the Dogs' Home.

9. Hydrophobia is relatively most fatal between the ages of five and fifteen.

10. At all ages, except the extremes of life, very many more males die than females. The same is believed to be the case with rabies among the lower animals.

11. Occupation seems to have comparatively little influence.

12. The geographical distribution of rabies is peculiar. It is most prevalent in Lancashire; Cheshire and the West Riding of Yorkshire coming next. It is least prevalent in Wales, in the eastern and the south-western counties.

ON THE RESULTS OF THE INTERNATIONAL SANITARY CONFERENCE OF ROME, 1885.

By R. THORNE THORNE, M.B.Lond., F.R.C.P.

(*Read: June 9th*, 1886.)

In May 1885 an International Sanitary Conference was held in Rome. Great Britain was represented by three delegates, namely, Her Majesty's Ambassador to the Court of Rome, Surgeon-General Sir Guyer Hunter, and myself. Sir Joseph Fayrer and the late Dr. Timothy Lewis represented British India.

In all, the Conference consisted of sixty-three delegates, thirty-one being medical delegates, and the majority of the others were the diplomatic representatives at Rome of their respective Governments. All the European States were represented, and delegates were present from countries as far distant as the Governments of South America, China, and Japan.

It was on the occurrence of the cholera epidemic in Egypt in 1883 that the Italian Government first entertained the idea of convoking a Conference to consider the value of the measures by which it had heretofore been sought to stay the spread of cholera into Europe; and the utter failure of the action taken during the epidemic of 1884 in Southern Europe led that Government to feel that the occasion for such a gathering was specially opportune. The two previous Conferences, at Constantinople in 1866, and at Vienna in 1874, had failed to result in any international agreement as to the measures best adapted to prevent the spread of cholera from one country to another; and not only so, but, as it was well put by the Italian Foreign Minister, the "most complete anarchy" continued to exist as regards the application of quarantine restrictions.

Soon after the opening of the Conference it was decided that the medical delegates should be constituted into a Technical Commission, and that they should in the first instance discuss the question of cholera prevention, and prepare a series of resolutions on the subject for submission to the plenary assembly. This was done, but when the plenary

Conference reassembled about the middle of June, it was felt desirable by some of the diplomatic delegates that they should have an opportunity of conferring with their respective Governments on the attitude which they should take with regard to the resolutions which had been arrived at by the Technical Commission, and under these circumstances an adjournment was decided on. For reasons that you will hereafter gather, the reassembling of the plenary Conference has not yet taken place, and under these circumstances it must be remembered that the conclusions which were arrived at in Rome, and to some of which I propose to direct your attention this evening, are provisional only.

Many of the conclusions of the Technical Commission may be passed over in a few words, for they embody principles which have long been accepted in this country, and they are hardly likely to give rise to discussion in this Society. Thus, it was decided, with the single dissentient voice of Turkey, that land quarantine and sanitary cordons were useless; and again a series of resolutions were come to as to the sanitary precautions to be taken with regard to shipping at all ports of departure. These regulations, in the main, dealt with matters which have already been adopted in this country, and they received the unanimous support of the delegates. So also a very useful code of regulations was prepared, with a view of securing the adoption, on board vessels, of all needful measures of sanitation, these being varied according as the vessels were regarded as "suspected" or as "infected". Some of the conditions which it was desired to impose were felt by us to be superfluous; but on the whole they were of considerable value, and they received our support. Another set of conclusions dealt with the adoption of sanitary measures on land. Some of the latter had reference to the control of international trains, and they were, in our opinion, in excess of the requirements of the countries to which they were to be applied. But if they erred it was not in a direction that affected any important principle, and we did not feel it our duty to oppose them.

On the whole, the several sets of conclusions to which I have adverted exhibited a substantial advance on the labours of the preceding Conferences. Never before had the great importance of cleanliness, and the adoption of intelligent sanitary measures, as means for preventing cholera, been so prominently brought forward. Again and again this point is more or less directly adverted to in the conclusions; and besides this, a definite conclusion lays it down as a controlling principle that real and complete measures of sanitary im-

provement, together with isolation, are the surest means for preventing the importation and propagation of cholera.

So, also, in the matter of disinfection, advance was made. It was for the first time admitted in a formal conclusion, that all articles coming from a country where cholera prevails are not necessarily infected ; that articles of clothing and merchandise do not call for any process of disinfection unless they have been actually soiled with choleraic discharges; and the absurd practice of fumigating individuals was indirectly condemned by a conclusion which laid it down that the only process of so-called disinfection which could properly be applied to the human subject was through the agency of baths, and this only when they had come into contact with the discharges of the sick.

Thus far, nearly all was gain. But by far the most important subject—namely, that of maritime quarantine—remains to be considered; and I am bound to say that, after carefully weighing the full meaning of the conclusions which were arrived at on this subject, I am of opinion that though on the surface there is some apparent progress, yet that in reality the decisions of the Technical Commission were of a retrograde character.

The discussion on this subject was opened on a report of a Sub-Committee, which had prepared a series of resolutions relating to the passage from beyond the Straits of Babelmandeb, through the Red Sea and the Suez Canal, into the Mediterranean. The first proposition laid it down that all steam-ships coming from beyond those Straits should be subjected to medical inspection in the Red Sea. The principle of medical inspection forms the basis of the English regulations against the importation of cholera, and at first sight such a proposition seemed most reasonable. But when the matter was discussed we had before us the whole scheme of the Sub-Committee, and from this it appeared that the inspection was not merely for the purpose of acquiring information, but that it was a preliminary to the imposition of a quarantine detention, whenever any case on board was regarded as "suspect". And not only so, but the sole judge as to whether a ship was suspect or infected, and whether in consequence her crew and passengers were to be compelled to disembark and to submit to detention at a lazaret on the shores of the Red Sea, was to be some internationally appointed medical officer. In short, if, in the case of a large troop-ship returning from India, some of the passengers happened to be invalided with dysentery, and this "independent" medical officer chose to regard them as suspect, any asser-

tions on the part of any number of British medical officers on board, to the effect that they were not cases of cholera, were to be altogether disregarded, and everyone on board was to be landed under conditions which, as is well known, would almost necessarily lead to the aggravation of any existing disease. The British and Indian delegations were therefore unanimous as to the necessity for opposing the resolution relating to inspection, but in so doing I took the opportunity of explaining distinctly that our opposition was not to medical inspection as such, but to inspection which was obviously intended as a preliminary step to the imposition of a useless, vexatious, and, so far as invalids were concerned, a dangerous quarantine detention. Several of us explained that it was the desire and the wish of the Governments we represented to submit to any regulation which had for its object the acquiring of information as to the health of those on board, and I told the Conference that, such information being given, it was open to those obtaining it to telegraph it to all the Governments of Europe, so that the latter might in turn refuse to allow any given vessel to enter their ports; but that we maintained the right to pass unhindered into the Mediterranean, and so on to own ports, for the sanitary arrangements and regulations of which we were responsible. As regards vessels going to foreign ports, we fully admitted the right of the Governments of the countries concerned to impose any regulations which they thought desirable, and it was also quite open to them, if they wished such vessels to be subjected to quarantine in the Red Sea rather than on their arrival in Europe, to make any arrangements they chose, to give effect to this, with the Turkish or the Egyptian Government. But we maintained that no British vessel passing from India to England had ever yet conveyed cholera to Europe, and hence that we could not, merely because other countries did not wish vessels from the East to enter their ports without first undergoing a period of detention, admit the right of anyone to say that British vessels coming to our ports and touching nowhere else should be otherwise than unhindered in their course.

At this stage a definite proposal was made by Sir Guyer Hunter, to the effect that all British ships, merchantmen, troop-ships, mail-vessels, and others, which neither communicated with Egypt nor with any other European port, should always be allowed to pass through the Suez Canal as through an arm of the sea. This proposition was based on a condition laid down in March 1884 by Lord Granville, then Foreign Minister, to the following effect:—"That ships were,

under all circumstances, to be allowed to go through the Canal in quarantine, but that any Power might, if it chose, make separate arrangements with the Egyptian Government in respect to ships arriving at Suez and bound for one of its own ports." The resolution only received the support of Great Britain and India, there being two abstentions, namely, Japan and Russia.

After this, a series of resolutions were passed relating to the proposed inspection of vessels, and to the imposition of the restrictions that were to ensue upon it, according as vessels were regarded as free from suspicion, as suspected vessels, or as infected vessels. The former, as also suspected vessels, in case there was medical evidence that there had been no case of cholera aboard, were to be allowed free *pratique* at once; and here there appeared to be an advance on the existing system. But quite irrespective of the fact that the so-called "independent" medical officer of the port was to be the sole judge as to the absence of all suspicion, the progress was almost entirely in appearance alone, as I shall explain hereafter.

Having opposed the inspection which was preliminary to the imposition of the restrictions referred to, the British and Indian delegations took no part in the several votes as to the method in which the several regulations were to be carried out; but they felt it their duty once more to enter a protest when the initial period of quarantine—a period of five days —was decided on. This was indeed the crucial conclusion adopted; and it is noteworthy that it was only adopted by a majority of four (13 ayes, 9 noes), the minority being made up of the delegates for Great Britain and India, who objected in principle to quarantine detentions; of the delegate for the United States of America, who opposed the application of any arbitrary time quarantine; and of the delegates for Brazil, Spain, Mexico, Roumania, Servia, and Turkey, who regarded the restriction as inadequate. Five of the latter States formed the minority in an amendment, which was rejected, to the effect that the detention should be of ten days' duration.

It will be observed that this period of five days is less than that recommended by the Vienna Conference, which, in 1874, decided that seven days should be the minimum initial period of detention, every such period being of course renewed as regards any group of the persons landed, so long as cases of illness arose which were either cases of cholera, or could be regarded as suspect. The true estimate of this diminution in the duration of the quarantine will be again adverted to.

Thus far I have spoken of this period of detention as one of quarantine. But it was not so designated by the Technical Commission. On the contrary, it was held by a majority that five days might be accepted as the period covering any probable incubation of cholera, and that a detention for this period was necessary for the purpose of "observation"; indeed, the detention was definitely styled a "period of observation". Both the British and the Indian delegations protested against this misuse of the term proposed, and we insisted on calling the detention a quarantine restriction. And perusal of the proceedings of the Conference, as also of another document to which I shall refer, prove how important it was for us to have maintained this attitude. And I, personally, feel convinced that if the detention had been correctly designated, there were other delegates than ourselves who, tired of the antiquated and useless quarantine detentions, would not have voted as they did; but the regulation being disguised under a new name, and this savouring of a scientific experiment, rather than of a measure aimed at hindering commerce and navigation, it received an amount of support which I cannot but think was not altogether intentional.

Our determination to refer to the detention in question under the name of quarantine led to a somewhat important discussion, during which a protest was raised by the French and German delegations to the application of the word "quarantine" to this measure of detention under "observation". M. Rochard (France), in addressing the Commission, at its eighth sitting, said: "M. Thorne Thorne assimile la visite médicale à un commencement de quarantaine. On était convenu de ne pas prononcer ce mot. Si les délégués français avaient voulu en parler, ils l'auraient fait d'une façon ouverte." And Dr. Koch (Germany), at the same sitting, said: "Je proteste contre la dénomination de quarantaine donnée à une observation de cinq jours." (See *Procès-Verbaux*, pp. 172 and 183.) As to this I would observe:—1. That speaking for the delegation from France, M. Brouardel, who was the reporter for the Sub-Committee on "Dispositions spéciales pour la Mer Rouge", had previously stated at the third sitting of the Technical Commission that the French delegation had come to the Conference with conciliatory views, on the basis of limiting, as far as possible, the duration of quarantine, "prête à limiter les quarantaines autant que possible"; and 2. That the word "quarantaine" has hitherto always been applied to such detentions. As to this I would refer to one of the conclusions arrived at by the Constantinople Conference, and which is to this effect: "Relativement à la quarantaine

d'observation et à la quarantaine de rigueur, la Conférence est d'avis que la différence entre ces deux régimes consiste en ce que la quarantaine d'observation est un temps d'épreuve, de simple surveillance, tandis que la quarantaine de rigueur consiste dans le débarquement au lazaret avec désinfection, et comprend toutes les mesures applicables à une provenance cholérique." So also, at the Vienna Conference, detentions for the purposes of "observation" were included under the heading "Système des Quarantaines", as opposed to the "Système de l'Inspection Médicale", and the process is referred to as "la quarantaine d'observation". In short, the system of "observation" advocated by the Technical Commission corresponds not only with that of quarantine, but is in fact the "quarantaine de rigueur" of the Constantinople Conference.

The word quarantine had thus evidently become distasteful to certain members of the Commission, and, as far as could be judged, some of the delegates regarded the conclusions arrived at on this subject as aimed at superseding the quarantine system. Indeed, the President of the Technical Commission, in addressing the Italian Minister of Foreign Affairs on the conclusion of the labours of the Commission, wrote, in the opening sentence of his communication*:—"La Conférence . . . . se distingue des conférences précédentes en ce qu'*elle a rejetté, sans reserve, les quarantaines.* Non seulement la Commission Technique, dans son travail préparatoire, a declaré inutiles les quarantaines de terre, et les cordons sanitaires, mais, en outre, elle a proposé de transformer les quarantaines maritimes en inspections et observations." I have already explained that the change referred to was, in my opinion, one of nomenclature only.

In opposing the imposition, by some unknown official, of quarantine in the Red Sea, we were also influenced by the knowledge that it could not be effectually applied; and we took occasion to point out the impracticability of the proper application of the system to such vessels as large British troopships, with their immense human freights. There were also two delegates present who had personal experience of the Red Sea and of its lazarets. One was the Russian, and he endeavoured to induce the Commission to accept a resolution to the effect that the restrictions specified were not to be carried out until arrangements had been made to give effect to them. In this effort he was unsuccessful. The

* *L'Œuvre de la Conférence Sanitaire de Rome*, par M. Jac. Moleschott. See reprint in *La Revue Scientifique*, 12th September 1885. [The italics are mine.—R. T. T.]

other was the Egyptian delegate, and he unfortunately arrived in Rome too late to take part in the discussions of the Commission. But he handed in a *Mémoire*, in which he pointed out that in so far as measures of isolation and disinfection in that sea were concerned, they were applied in a manner which was altogether insufficient and untrustworthy ("tout à fait insuffisante et illusoire"), and this because the means for their proper application did not exist. And it was under these circumstances that he felt it his duty to support the demand of the British delegation as to the free passage of the Red Sea, such being the only practical solution of the difficulty, in view of the state of unpreparedness, in so far as the application of quarantine measures was concerned.

[A recent example of the impracticability of carrying out the measures which are professedly in operation in the Red Sea occurred in the autumn of 1885. Two French transports, the *Château Yquem* and the *Nive*, from Tonquin, were ordered into quarantine at Tor under the cholera regulations. The *Château Yquem* reached that place on October 29th, the passengers and ninety men of the crew were landed, about a dozen being accommodated in a hut, and the remainder under canvas. The *Nive* arrived there on November 3rd, and on her arrival the Director of Encampment having pointed out that if all were compelled to land under the existing climatic conditions, and in view of the character of the accommodation available, the result would be to aggravate the then prevailing sickness, and to lead to an increased mortality. In the end, some of the more healthy amongst the passengers were sent ashore, but those who were really ill (the cases are described as dysentery, fever, etc.) were left on board; the adoption of sanitary measures being in the main relied on.]

The system of quarantine having been decided on for the Red Sea, the Technical Commission also resolved to recommend its imposition at all ports of arrival, and especially in the Mediterranean. As regards the latter sea, suspected ships were to land all their crews and passengers for a period of either three or six days, according as they carried a medical officer or not. Many Powers desired a more severe detention, and these, uniting with such opponents as the delegates from this country, who were opposed to all quarantine detentions, the resolution was only carried by six ayes against five noes, there being no less than ten abstentions, and the majority only included two Mediterranean Powers. As regards infected vessels, they were to be dealt with in a manner which it had been decided should affect ports of arrival in general. But in the case of the latter class of

vessels the united period of detention was only to be five days, whereas, as already explained, some of the suspected vessels in Mediterranean ports could be detained for six days. And so it happens that, according to these conclusions, a vessel that is merely suspected can, in the Mediterranean, be detained for one day longer than a vessel which is really infected. I am glad to say that the British and Indian delegations took no part in a vote leading to such a conclusion.

Amongst the many other subjects that were dealt with was that of the Mecca pilgrimage, and there is just one of the conclusions as to this that I should like to refer to. It sanctioned a quarantine detention of five days' duration in the event of medical inspection showing that there was either a suspicion of cholera having occurred on board during the passage, or of the disease being actually present; the detention involving the disembarkation of all on board and disinfection of the vessel.

There is at first sight an apparent inconsistency in the attitude which we took in being party to a vote which gave sanction to a five days' quarantine detention of all pilgrims, healthy as well as sick, under the conditions specified in the conclusion relating to this subject, when compared with the refusal to assent to a similar regulation in the case of the ordinary traffic from the Red Sea into and through the Mediterranean. The attitude taken was, however, I venture to submit, entirely consistent. The opposition taken by my colleagues and myself to the general measure of quarantine was based on the demand which was made on behalf of Great Britain that she should deal as she saw fit with such vessels as sailed to her own ports without touching elsewhere during the voyage; and I took occasion to point out, during the debates on this subject, that Great Britain, in demanding the free passage of the Suez Canal as an arm of the sea, made no demand which was exceptional to herself, but maintained that each country should be allowed to deal as it chose (*i.e.*, by medical inspection or by the imposition of quarantine restrictions) and where it chose with regard to vessels bound for its own ports, and both Sir Joseph Fayrer and Sir Guyer Hunter took the opportunity, during the discussion on the Mecca pilgrimage restrictions, to point to this principle as guiding us in our votes. But in dealing with the disembarkation of pilgrims, we had to remember that Turkey desired quarantine restrictions at its ports in the Red Sea; and just as we maintained our right to be free from such restrictions as regards vessels

sailing to our own ports, so we felt it due to Turkey not to oppose her wishes as regards those bound for her ports. But directly it was attempted to impose similar restrictions to pilgrim vessels which were bound to Mediterranean ports of no specific nationality, we felt that we could not take any part in imposing on the Mediterranean Powers restrictions to which we had made objections on the ground that they were useless in so far as British ports are concerned.

Returning for a moment to the attitude which we took up of opposition to quarantine, we felt that we ought to give some indication of the alternative which we aimed at securing, and hence at an early stage of the proceedings I had explained how, under the regulations in force in this country, our coast-line was surrounded by sanitary districts, each having its complement of officials, always including a medical officer of health, and how a large number were already provided with hospitals for the isolation of the sick. I had also explained that only the sick and persons actually suspect could be detained, the limit of detention in the case of the latter being a period of forty-eight hours for real purposes of observation, whereas the healthy were allowed to land provided the addresses to which they were going were communicated to the officials, who in turn communicated with the medical officers of health of the districts concerned. But, after all, this was only one of our means of prevention, and I think we were all agreed that it was necessary to let the Conference understand that our opposition to quarantine was mainly based upon the conviction that if populations are led to believe that their Governments will protect them against cholera by drawing lines around their homes—whether sanitary cordons on shore or maritime quarantines on the water—those populations are not likely to secure for themselves the greatest of all means of prevention against disease, namely, improved sanitary circumstances. We all spoke with decision and conviction on this point, and I undertook to give the Commission some notion of the sanitary work that had been effected in this country since the system of medical inspection had, with the approval of the Vienna Conference in 1874, superseded all attempts at quarantine both on our shores and inland.

Recalling the measures taken on our coast-line in connection with the system of medical inspection, and referring to these as constituting our first line of defence, I pointed out the great importance which was attached throughout the country to the improvement of the sanitary circumstances under which the people lived, and especially to the provision of wholesome water-supply, of efficient means of sewerage and

house drainage, of healthy dwellings, and of small local hospitals for the isolation of first attacks of all cases of dangerous infectious diseases, including cholera. I then referred to the action taken by the Local Government Board, through the agency of its staff of Inspectors and otherwise, in urging the importance of these matters on the Local Sanitary Authorities, and having explained that in this country the cost of all such measures was borne exclusively by the local authorities, I furnished some statistics as to loans which such authorities had, with the sanction of the Board, incurred for sanitary purposes since the date of the Vienna Conference. [When I was in Rome, the materials at my disposal, as to loans raised by Sanitary Authorities, were limited to those with which the Local Government Board have had concern. But quite apart from these, large sums are raised year by year under private Acts, and without the sanction of the Board; and since my return I have had opportunity of ascertaining that, including loans raised both under private and public Acts for purposes mainly of a sanitary character, the average amount for the period 1875-76* to 1883-84 exceeded 6½ millions sterling per annum. It is true that in certain years the loans so raised have included considerable sums for objects such as gasworks; but, on the other hand, no account has been taken of loans raised under the Artizans' and Labourers' Dwellings Acts, and the cost of many public works of water-supply has been defrayed by private companies, whose operations are not included in the above estimate. And not only so, but examination of the current expenses of Sanitary Authorities shows that, during an ordinarily typical year, the cost of measures essentially sanitary in their influence exceeds 2½ millions; this amount leaving altogether out of consideration the payment of principal and interest on loans, and, in almost all cases, also of the salaries of sanitary officers. And, further, the above-named figures relate solely to the provinces, and take no account of the large loans and current sanitary expenses of the metropolis. Lastly, I would note that I took occasion to explain to the Technical Commission that expenditures such as I have referred to are, with only very trivial exceptions, voluntarily incurred in the interests of public health.]

I then went on to show that as a result of this expenditure the average annual mortality for England and Wales was now only 19 as opposed to 22 per thousand in the decennial period 1861-70, and this notwithstanding an increase in population of some five millions; and taking the continued fever mortality

* This is the first period for which the necessary statistics are available.

of this country as that which, in point of causation, most nearly resembled cholera, I pointed out that whereas in the five years 1865-69 this mortality was at the rate of 934 per million living, it had steadily fallen to 428 per million during the period 1880-82, and that it was now only 307 per million. Referring to the allegation which has at times been made to the effect that the views of Great Britain on the quarantine question were largely influenced by commercial and financial considerations, I maintained that there was no country where a higher value was set on human life, and that if England had really believed in the efficacy of quarantine measures, the financial burden which it involved would have been borne in the interests of the community as readily as had been the expenditure above referred to in connection with the alternative system of coping with disease, whether imported or otherwise, by an efficient sanitary administration. Finally, I maintained that many of the most important sanitary measures adopted in England had been brought about in anticipation of the possible importation of cholera; that no such saving of life as had been effected would have been secured if the English people had been led to put their trust in quarantine restrictions, and that the substitution of the system of quarantine which the Technical Commission desired to urge upon the Conference, in replacement of the system which has been elaborated in this country, could only have a disastrous effect.

Reviewing the labours of the Commission with respect to the important question of quarantine as applied to the sea traffic from the East into the Mediterranean by means of the Red Sea and the Suez Canal, I would recall the fact that in certain respects they are less stringent than those which were adopted at Vienna. Comparison of the conclusions arrived at Vienna in 1874, and at Rome in 1885, gives the following results:—

Vienna, 1874.	Rome, 1885.
a. Vessels from Suspected Ports.—*Five* days' quarantine.	*a. Suspected Vessels.*—Medical inspection near Suez. If the officer making it is satisfied that there is an absence of all suspicion, free pratique to be immediately granted.
b. Vessels from Infected Ports.—*Seven* days' (or, in certain exceptional cases, *ten* days') quarantine. Towards the several periods of five, seven, and ten days, the duration of the voyage is to reckon, subject, however, to a detention of twenty-four hours, even when no suspicious case of cholera has arisen on board.	*b. Infected Vessels.*—Five days' quarantine.
c. Infected Vessels.—If any case, or suspected case, has arisen during the voyage, seven days' quarantine.	

As to vessels which are not regarded as suspect or infected, the difference is, however, more apparent than real, for the inspection required by the Rome conclusions, in order to enable the port medical officer to grant free pratique, would of necessity occupy some hours, and this especially in the case of night arrivals, when the passengers would be in bed, and it is only in so far as the number of hours occupied in the inspection might fall short of the twenty-four hours' detention prescribed by the Vienna conclusion that there would be any gain. Indeed, in the absence of the staff necessary to make the proper inspections, the existing authorities at present accept, in the case of such ships as troop and mail steamers carrying a European medical officer, and having undergone a sea voyage of not less than ten days, the declaration of that officer and of the captain, and even the detention of twenty-four hours, is thus, in practice, avoided. As regards infected vessels, the minimum period of quarantine detention is reduced from seven to five days.*

The reduction in stringency amounts, therefore, (1), in the case of non-suspected vessels, at the most to a few hours; and (2), in the case of infected vessels, to forty-eight hours. The gain is, of course, very trivial; and in view of the recent experience we have had of the failure of the existing regulations to protect Europe from invasion by cholera, it is difficult to understand how any different result could be expected, were the slight modifications suggested by the Technical Commission carried into effect. Their main, if not only, value lies in the fact that by once more diminishing the duration of quarantine detentions, they may constitute a further step towards their entire abandonment.

But in dealing with the action to be taken at ports of arrival, and especially at ports in the Mediterranean, the action of the Conference had a distinctly retrograde tendency. The Vienna Conference, whilst laying down regulations as to quarantine detentions for those countries which preferred to retain the quarantine system, recommended the system of Medical Inspection for adoption in European ports, this system involving the isolation and detention only of such persons as are found on arrival to be suffering from or actually suspect of cholera; the healthy being admitted to free pratique after certain processes of disinfection have been carried out. But in the conclusions of the Technical Commission of the Rome Conference, medical inspection finds no place, except in so far as this term may stand for a formality preliminary: (1),

* The restrictions as to "Petits Navires" are more stringent, in so far as two medical inspections, instead of one, are required.

to a detention of twenty-four hours in cases where the sea voyage from suspected ports has lasted less than ten days, and this not only in cases where cholera, though not then present, has prevailed on board within the previous ten days, but also when no suspicion whatever exists of cholera either being or having occurred on board; and (2), to the imposition of a five days' quarantine on sick and healthy alike.

The attitude of the British and Indian delegations was, as already explained, adverse to all these quarantine restrictions, and in opposing them we were strongly influenced by the knowledge of the great benefits and saving of life which in this country had followed on the system of sanitary administration which had replaced restrictions on the movements of healthy persons, and by the renewed experience of 1884, as to the impossibility of preventing the development of cholera in Europe by means of the quarantine restrictions in force both in the Red Sea and in Mediterranean ports. I was also impressed with the fact that, whereas the authorities and inhabitants of sanitary districts have, in this country, indicated their belief in a system of sanitary administration on which they rely for the prevention of cholera and other preventable diseases by voluntarily incurring a large expenditure in their efforts to mature it, there was, as regards many countries which professed to believe in the applicability of quarantine measures to their ports, an absence of any evidence to show that the authorities so far believed in their efficacy as to have prepared themselves beforehand with the necessary means for the efficient enforcement of those restrictions.

On this very important question of maritime quarantine we were defeated, and this by an overwhelming majority. But our refusal to accept the views of the majority was, I believe, the main cause of the adjournment of the Conference. Time has been given by means of this adjournment for a careful consideration of the scope and bearing of the code of resolutions which the Technical Commission submitted to the plenary Conference, and on the part of the country which called together the Conference the interval has been used in the preparation of a document which cannot fail to have a great influence upon the Conference when it shall reassemble, or upon any future Conference that may deal with this subject. The document I refer to was issued by the Italian Foreign Office at Rome, and it cannot but be regarded as one of the most important—if not the most important—outcome of the assembly. It deals, in the first instance, with the conclusions of the Technical Commission with regard to the Red Sea and the Suez Canal, and it urges that an understanding between

the several Governments on this subject is imperatively called for. It next refers to the existing Egyptian control, and it explains that since the quarantine stations in the Red Sea are absolutely deficient in the arrangements on shore which would be necessary for the carrying out of the processes of isolation and disinfection, no attempts are, as a matter of fact, made to carry these processes into effect. Proceeding to review the action which the Technical Commission proposed to render obligatory, it takes up the point referred to by me of the impossibility of dealing effectually, under quarantine restrictions involving disembarkation, etc., with large vessels containing some 1,000 or 1,500 persons on board, and it goes on to say that it is not only with one such vessel, but with two, three, four, or even a larger number of infected vessels arriving together at Suez, that the restrictions will have to deal. And having, in detail, set out the utter impracticability of the scheme as proposed by the Technical Commission, the document goes on to say that, subject to certain reforms, which would go to render efficient the passage of the Suez Canal in quarantine, the British proposal "concerning the passage in quarantine for all her vessels might be accepted, from the present time forward, without exposing Egypt, and consequently Europe, to any danger from the epidemic." And they enforce this view by stating that a certain regard to the interests and to the scientific views of Great Britain is justified by the fact of the large number of British vessels annually passing through the Canal, and of the importance which England naturally attaches to the necessity for means of rapid communication with her Indian Empire.

Thus, as the outcome of the debates of the Technical Commission of the Rome Conference, at which Great Britain and British India found themselves in a minority of two on this vital question of the unhindered passage of the Suez Canal, the Italian Government, who from the first have taken the initiative and the lead in dealing with the question of the need for a revision of the existing restrictions, has undertaken to support, in its communications with the several Governments of the civilised world, the demands of this country. It has done so in language which must, I think, in the long run, carry conviction, and the effect of it will be far stronger than if our views had emanated from us alone. I would therefore submit to you that the outcome of the Rome Conference will ultimately prove to have materially assisted in securing a proper solution of this vexed question of maritime quarantine.

REPORT OF THE VACCINATION COMMITTEE.

THE Committee* appointed by the Society beg to present their Report on the evidence which the present state of medical knowledge supplies as to the conditions affecting the protection afforded by vaccination against death† by small-pox occurring in persons contracting that disease.

In the first instance they desire to cordially thank those medical men who have assisted them to obtain the information upon which this report is based.

The Committee's task has been no easy one, owing to the fact that those engaged in active professional duties are often prevented from recording at the time notes of the kind required by the Committee. They have, however, been fortunate in obtaining from the small-pox hospitals of the Metropolitan Asylums Board at Deptford, Fulham, Homerton, and other sources, the statistics of nearly 10,000 cases,‡ amongst the largest contributors of this information being Drs. Collie, Gayton, MacCombie, and Sweeting.

The Committee have principally directed their attention to the amount of protection against death by small-pox afforded by infantile vaccination of one and another kind. This part of their investigation they have not extended to ages after 20 years of life. They have also examined the amount of protection afforded by re-vaccination, especially among the attendants upon small-pox patients. Information, too, has been sought as to subsequent attacks of small-pox in the same person, and as to insusceptibility to vaccination, especially as to insusceptibility in the babies of mothers who during the pregnancy have passed through an attack of small-pox. The following questions have been asked:—

I.—What cases of small-pox have come under your observation among children under ten years of age who have been vaccinated in infancy; and, of these, which have died?

Please answer this question by filling up Form A or A 1.

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* Dr. Robert Cory, Dr. John MacCombie, and Mr. Shirley Murphy.

† The Committee would especially warn the reader that these statistics, with the single exception of the data respecting re-vaccinated persons employed at small-pox hospitals and in attendance on small-pox patients, do not in any sense profess to measure the *liability to attack* by small-pox of any class of persons, whether vaccinated or unvaccinated.

‡ See foot-note, page 151.

II.—What cases of small-pox at ages from ten to twenty years have come under your observation among those who have been vaccinated in infancy?

Please answer this question by filling up Forms B and B 1.

[It has been found necessary to arrange the forms to suit the convenience of (1) those who have registered the number and quality of vaccination cicatrices, and have omitted to note the superficial area which these cicatrices occupy, as well as (2) those who have recorded the quality of the cicatrices and the area occupied by them, but have omitted to note the numbers of cicatrices; for the former, forms A and B have been prepared, for the latter, A 1 and B 1. In filling up A and B, "good" vaccination includes only those cicatrices which are foveated, and "indifferent" vaccination only those cicatrices which are plain or unfoveated. In filling up A 1 and B 1, "good" vaccination includes only those cases possessing cicatrices which are foveated, and which, together, occupy not less than one third of a square inch; "indifferent" vaccination includes cases possessing plain or unfoveated cicatrices and foveated cicatrices which, together, occupy less than the above area.]*

III.—What cases of small-pox after re-vaccination have come under your observation?

In answering this question, please state, as far as possible:—

(*a*) The number and character of the primary vaccination cicatrices.

(*b*) The age of the patient at the time of secondary vaccination; the number and character of the resulting cicatrices. If none remain, please state the fact, as well as any fact as to the maturity of the vesicles or intensity of the inflammation.

(*c*) The character of the attack of small-pox, and the result.

(*d*) The age of the patient at the time of the attack of small pox.

(*e*) The sex of the patient.

IV.—(*a*) How many persons have you known to be in personal attendance on cases of small-pox?

(*b*) How many of these had previously had small-pox?

(*c*) How many of these have contracted small-pox?

(*d*) How many of those who did not contract small-pox were re-vaccinated?

(*e*) How many of those who contracted small-pox were re-vaccinated?

Of the last, state the character of, and date of, vaccination; the date, character, and result of attack of small-pox.

V.—How many cases of small-pox have come under your observation in which the patient had previously suffered from this disease?

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* The necessity which the Committee have since found of separating, for the purposes of classification, all cases possessing foveated vaccination scars from those possessing unfoveated scars, has made it impossible for them to use the returns which relate to "area and not quality", and which group under the heading "Indifferent Vaccination" cases with foveated scars, having a combined area of less than one-third of a square inch, with cases possessing plain or unfoveated scars. In reference to number of scars, it is greatly to be regretted, for a reason which will presently appear, that the data supplied to the Committee make no distinction between three *and more than three* scars.

VI.—Have you ever met with a case of insusceptibility to primary vaccination, and if so, how many?

VII.—Have you ever vaccinated any child whose mother suffered from small-pox during the pregnancy, and if so, with what results?

In reference to the protection against death by small-pox afforded by infantile vaccination to persons attacked, subsequently to their vaccination, by that disease, the Committee have, of course, had regard to the fact that the tendency to death on attack by small-pox is not, for unvaccinated persons, the same at all ages. This fact is well illustrated by Dr. Gayton, whose table, showing the fatality of small-pox among admittedly unvaccinated persons attacked by the disease at various periods of life, is here made use of.

Admittedly Unvaccinated Persons.

Age-period, Years.	Admitted.	Died.	Mortality per cent.
0– 5	677	383	56.5
5–10	510	180	35.2
10–15	317	74	23.3
15–20	204	86	42.1
20–25	174	83	47.7
25–30	105	56	53.3

The table shows that of unvaccinated persons attacked by small-pox in the first five years of life, more than half die of the malady. In the next five years (5-10) the small-pox mortality among such persons becomes reduced to little more than a third of those attacked. At the age-period 10-15, liability of unvaccinated persons to die of small-pox, when attacked by the disease, is at its minimum, less than one-fourth dying when thus attacked. But after the age of fifteen years the fatality of small-pox among unvaccinated persons increases, and at middle life one-third to one-half of such persons die if attacked by the disease. Taking the fatality of the disease, as observed among unvaccinated persons by Dr. Gayton, as a standard of comparison,* we have examined the data furnished us in reference to the fatality of the disease at several periods of life up to twenty years, among persons possessing, at the date of their attack by small-pox, "vaccination" of

* The Committee regret that the information they have received does not admit of grouping of the cases in every instance into age-periods identical with those of Dr. Gayton's unvaccinated table. The Committee, however, believe that for all practical purposes in relation to what follows the age-periods in each may be regarded as the same.

various sorts, and we now state the results of this examination briefly, and as much as possible in tabular form. For convenience we use, in the text, rates of fatality; but in all cases we give in appendix the numbers on which the rates are based. As a result of our division and subdivision of the cases furnished us, some of our data are, it will be observed, of necessity based on small figures only, and accordingly our inferences thereon are, to a certain extent, provisional inferences. We believe, however, that all the indications of this Report will, in the end, be found to be true indications.

Dealing broadly with the subject in the first instance, the vaccination of some seven thousand five hundred of the small-pox cases returned to us may be classed roughly under three heads: (*a*) "stated to have been vaccinated but having no cicatrix" (nominal vaccination); (*b*) "vaccinated, and having plain or unfoveated cicatrices" (imperfect vaccination); and (*c*) "vaccinated, and having well foveated cicatrices" (good vaccination).

The records of appearances of cicatrices are necessarily dependent upon those appearances at the time of attack by small-pox. The Committee recognise that not every cicatrix which is once foveated will always retain its condition of foveation, and, further, that not every cicatrix will permanently exist. The circumstances which give rise to these changes in cicatrices need not be here discussed in detail; it is enough to note that the permanence of vaccination cicatrices and of their foveation is dependent, in the main, on two conditions: namely, on the character of the original vaccination, and on the influence of time as modifying the individual who received it.

Table I(*a*) gives the fatality among small-pox patients under each of these headings at several age-periods up to twenty years, and also the fatality of the disease at corresponding age-periods among patients confessedly unvaccinated.

In Table I(*b*) the fatality among unvaccinated small-pox cases is taken as 100 in each age-period, and the other rates in Table I(*a*) are corrected on this assumption, to enable a comparison to be made between fatality of small-pox among unvaccinated and vaccinated persons respectively.

TABLE I(*a*).

Age-period, Years.	Unvaccinated.	Age-period, Years.	Vaccinated.		
			(*a*) Nominal.	(*b*) Imperfect.	(*c*) Good.
0- 5	56.5	0- 5	36.6	11.0	1.5
5-10	35.2	5-10	26.6	5.2	1.5
10-15	23.3	10-14	21.3	3.5	1.1
15-20	42.1	14-20	26.3	6.3	2.6

TABLE I(*b*).

Age-period, Years.	Unvaccinated.	Age-period, Years.	Vaccinated.		
			(*a*) Nominal.	(*b*) Imperfect.	(*c*) Good.
0– 5	100	0– 5	65	19	2.6
5–10	100	5–10	75	15	4.2
10–15	100	10–14	91	15	4.7
15 20	100	14–20	62	15	6.1

These tables appear to give the following indications:

1. *As to the age-period* 0-5 *years.*—This is the period when small-pox is most fatal to unvaccinated patients, and the period, therefore, when the conflict between vaccination and liability to death from small-pox is keenest.

Nominal (*a*) vaccination at 0-5 years, *i.e.*, vaccination in regard to which no scar is discernible at date of attack by small-pox during this age-period, is a comparatively small protection against death from small-pox; the fatality of the disease in small-pox patients having vaccination of this sort being no less than 65 per cent. of that witnessed in unvaccinated persons of the same age.

It is an interesting question how far a vaccination which, within five years of its performance, has left no scar at all, has been originally an "unsuccessful", or even a sham, vaccination; indeed, whether, in a large proportion of these cases there has been any attempt whatever at vaccination.

Imperfect (*b*) vaccination at 0-5 years, *i.e.*, vaccination in regard of which unfoveated scars are visible at the date of attack by small-pox during this age-period, has the effect of very greatly reducing the fatality of small-pox; the fatality of the disease being, in this class of vaccinated patients, only 19 per cent. of that witnessed in unvaccinated patients of similar age.

The contrast, however, between the protection afforded at 0-5 years by "imperfect" vaccination and by "nominal" vaccination is not without significance as to the real meaning of "nominal" vaccination *at this age.*

Good (*c*) vaccination at 0-5 years, *i.e.*, vaccination in regard of which the scars at the date of attack by small-pox during this age-period are well foveated, is an enormous protection against death by small-pox; the fatality of the disease in this class of vaccinated persons at 0-5 years being but 2.6 per cent. of that witnessed in unvaccinated patients of similar age. Similarly, it is only 4 per cent. of that in class *a* (nomi-

nal) vaccination, and not more than 13.6 per cent. of that in class *b* (imperfect) vaccination.

2. *As to the age-period* 5-10 *years.*—That in which the liability to death among unvaccinated small-pox patients is diminishing.

Nominal (*a*) vaccination at the age-period 5-10 years is even less protection against death by small-pox than in the preceding quinquennial period. In unvaccinated persons the fatality is 35.2 per cent. in the age-period 5-10 years, as compared with 56.5 per cent. in the age-period 0-5 years; while, as regards nominal vaccination, the fatality in the age-period 5-10 years is 26.6, as compared with 36.6 in the age-period 0-5 years. Though there is a diminished fatality at 5-10 years as compared with 0-5 years, both in unvaccinated patients and in patients possessing nominal vaccination, the diminution is not equal in the two classes. Indeed, regarding the fatality of unvaccinated patients in each age-period as 100, the fatality of the nominally vaccinated patients is, in the period 0-5 years, 65, and in the period 5-10 years, 75. Such actual diminution of small-pox fatality as is witnessed at 5-10 in nominally vaccinated children, as compared with the same class at 0-5 years, is therefore probably due to the age of the patients alone, and not at all to vaccination; this class, indeed, appears relatively less effectively protected by vaccination against death from small-pox at the age-period 5-10 years than at the age-period 0-5 years.

This fact is consistent with nominal vaccination at 5-10 years having been, so far as it was vaccination at all, altogether perfunctory vaccination.

Imperfect (*b*) vaccination at the age-period 5-10 years. The fatality of small-pox among patients possessing this sort of vaccination at this age-period is but 15 per cent. of that witnessed in unvaccinated patients. In the age-period 0-5 years it is 19 per cent. that of the unvaccinated. At the age-period 5-10 imperfect vaccination is therefore relatively more protective than it was at 0-5 years.

This apparent increase of protective power of imperfect vaccination obviously requires explanation. The influence of time upon the amount of protection afforded by vaccination can only (so far as is known) be to diminish it; there is certainly no known circumstance that can increase it, and the explanation of the above fact is, in all probability, as follows:—It is conceivable that some children, whose vaccination cicatrices in the age-period 0-5 years qualified them for rank in class *c* (good vaccination), would, in course of time, lose this position, owing to changes in the appearance of the cicatrices, so that, at the time of attack by small-pox, they would be grouped by an observer with children whose cicatrices had been throughout of inferior quality, *i.e.*, class *b*, imperfect vaccination. The effect of such transfer from class *c* to class *b* would undoubtedly be to add to

the latter class persons losing, indeed, their protection, but still fairly well protected against death by small-pox. and in this manner the lessened rate of fatality of small-pox in this class may be accounted for.

Good (*c*) vaccination. The fatality of small-pox among patients in this class at the age-period 5-10 years is 4.2 per cent. of the unvaccinated at the same age-period, whereas during the previous quinquenniad it was 2.6 per cent. that of the unvaccinated. Instead, therefore, of there being, as with the *b* class, a diminution of fatality at 5-10 as compared with the age-period 0-5 years, there is, in *c* class, a decided increase of fatality, and a considerable loss of protection in this class is therefore indicated. Nevertheless, at 5-10, "good" vaccination remains vastly superior to either "nominal" or "imperfect" vaccination; the fatality of small-pox in this (the *c*) class being only 5.6 per cent. of that in *a* (nominal) class, and not more than 28 per cent. of that in *b* (imperfect) class vaccination.

No doubt seeming inferior retention of protection at 5-10 years by the *c* class, as compared with *b* class, appears paradoxical. But it must be recollected that good class (*c*) vaccination cannot have accessions to its ranks from a better vaccinated class, seeing that (apart from revaccinated persons, which are not here considered) this, the *c* class, is the most perfectly vaccinated class. The effect, therefore, of time in producing diminution of protection against small-pox death in this class is, in all probability, truly indicated here.

3. *As to age-period* 10-14 *years.* The period of life at which the fatality of small-pox in unvaccinated persons is at its lowest.

Nominal (*a*) vaccination. The fatality of small-pox in this class at 10-14 years is practically identical with that in unvaccinated persons at the same age-period, the latter being 23.3, the former 21.3. The protective power of nominal vaccination is, therefore, at 10-14 years gone, or very nearly gone.

Here, be it observed, there is no indication of a disturbing element, such as by accessions to this class from a superior class, and it is probable enough that a longer period is required for the complete obliteration of a vaccination cicatrix than for the mere loss of foveation.

Imperfect (*b*)-vaccination. The fatality of small-pox in this class at the age-period 10-14 years is 15 per cent. of that among unvaccinated patients at the same age-period. At 5-10 it was also 15 per cent.; it is therefore unaltered, there is neither loss nor gain of protection.

This state of equilibrium of class *b* at 10-14 years is, in view of almost complete loss of protection in class *a* at this age, a very striking circumstance. As has been said, there is no indication of transfer at 10-14 years to class *a* of the worst protected cases from

this (*b*) class, and, accordingly, it may be inferred that class *b* owes the stability of its protection at this age to transfer to it of fairly well protected children from class *c*. Indeed, as already stated, it is conceivable that with increase of years foveation of vaccine scars may tend to disappear some considerable time before the scars themselves become obliterated.

Good (*c*) vaccination. The fatality of small-pox in this class in the age-period 10-14 years is 4.7 per cent. that among unvaccinated patients of the same age. At 5-10 years it was 4.2 per cent. There is slight loss therefore of protection with increase of age in this class. As before, however, "good" vaccination easily maintains its superiority over other vaccination, the fatality of small-pox in this (the *c*) class at 10-14 years being but 5.2 per cent. of that in class *a* (nominal) vaccination, and not more than 31.3 per cent. of that in class *b* (imperfect) vaccination.

The figures upon which the rate during 10-14 years is calculated are small, but in reference to suggestion of some loss of protective power, it may be here noted again that this class cannot receive accessions from a superior class.

4. *As to age-period* 14-20 *years*, the life-period at which the fatality of small-pox in unvaccinated patients is once more rapidly increasing.

Nominal (*a*) vaccination. The fatality of small-pox in this class at the age-period 14-20 years is 62 per cent. of that witnessed in the unvaccinated class at the same life-period. At 10-14 years it was nearly the same in both classes. The absolute increase of fatality from that at 10-14 years is therefore very much less in this than in the unvaccinated class.

Nominal (*a*) vaccination would, under these circumstances, appear to have gained protective ability between the ages 10-14 and 14-20 years, which appears out of question. It is highly probable, however, that by this time some persons whose vaccination would earlier have entitled them to rank in class *b* (imperfect) vaccination, have, after 10 years of age, so completely lost their scars that they have been reckoned with the worst vaccinated class, and that this is the reason why the latter exhibits a less fatality from small-pox.

Imperfect (*b*) vaccination. The fatality of small-pox in this class of patients in the age-period 14-20 is 15 per cent. that of the unvaccinated. At 10-14 it was also 15 per cent.; once more, therefore, there is neither loss nor gain of protection in this class.

The stability of protection in this class at 14-20 may be explained partly, as suggested above, by transfer of cases to class *a*, partly, as at 10-14, by accession of persons whose vaccination would at an earlier period have entitled them to rank in class *c* (good vaccination), but whose vaccination scars have since lost their foveation.

Good (*c*) vaccination. The fatality of small-pox in this class of patients in the age-period 14-20 years is 6.1 per cent. of unvaccinated persons at the same life-period. At 10-14 it was 4.7. There is here, therefore, evidence of loss of protective power in this class, and the loss is parallel to that observed in the unvaccinated class, as was to be expected. Nevertheless, at 14-20 years, "good" vaccination retains a marked superiority to all other vaccination; the fatality in this (the *c*) class being but 9.8 per cent. of that in class *a* (nominal) vaccination, and not 41 per cent. of that in class *b* (imperfect) vaccination.

The chief facts thus far may now be summarised.

1. Liability to death from small-pox of persons aged twenty and under, suffering attack is, in the vaccinated and in the unvaccinated respectively, influenced by the age of the patient at date of attack.

2. Among unvaccinated small-pox patients more especially, liability to death is influenced by the condition of age. Among them it is at its maximum in the first five years of life; at its minimum at ten to fifteen years of age; and after fifteen it somewhat rapidly increases again.

3. Among vaccinated small-pox patients liability to death, though influenced to some extent by age, is in the main governed by the character of the vaccination possessed by the individual patient, as evidenced by his vaccine scars at the date of his attack. Thus:—

a. Small-pox patients having "nominal" vaccination at the date of their attack, die, according to their age, from $\frac{6}{10}$ to $\frac{9}{10}$ the extent of unvaccinated patients at corresponding ages. Such influence as the miscellaneous vaccination and no vaccination of this class may possess is most conspicuous at the extremes of the ages under review, viz., 0-5 and 14-20. Between 10 and 14 the fatality of small-pox attack in this class is practically identical with that in the unvaccinated class of corresponding ages.

β. Small-pox patients having "imperfect" vaccination at the date of their attack, die, according to their age, from $\frac{5}{35}$ to $\frac{7}{35}$ the extent of unvaccinated patients at corresponding ages. They have received a part only of the protection that vaccination can give; and its protective influence, instead of being conspicuous in early life (when children are especially prone to die if attacked by small-pox, and when, therefore, the fullest protective

that vaccination can give, is most urgently called for), is most discernible after the age of five years.

γ. Small-pox patients having "good" vaccination at the date of their attack, die, according to their age, from $\frac{2}{80}$ to $\frac{5}{80}$ only the extent of unvaccinated patients at corresponding ages. The distinction between the two is most marked in the case of those ages when, in the absence of vaccination, the liability to death is greatest, namely under five years of life. The absolute probability of fatal ending lessens further, indeed, if the attack be deferred till age has advanced to 10-14 years, for in vaccinated people, as well as unvaccinated, the postponement of attack to this period is found to help toward recovery; and the liability to a fatal termination is, further, in a measure regained (again as in the case of the unvaccinated) as the age of twenty is approached.

There can be no doubt whatever, then, that as a protection against death by small-pox "good" vaccination,—*i.e.*, vaccination producing persistent well foveated scars,— is upon all counts pre-eminent. The next question is, what is the "best" vaccination?

Herein is involved consideration of *quantity* as well as quality of vaccination; and accordingly examination has been made for the period of life (0-20 years) under consideration of the fatality of small-pox as it has affected persons possessing, at the date of their attack, one, two, three or more scars each, on the one hand of "good" and on the other of "imperfect" vaccination. The process of division and subdivision thus entered on of the cases reported to us, has in certain instances resulted in somewhat paltry figures as bases of calculation, so that inferences, therefore, have to be drawn with caution. Nevertheless, the Committee has decided to present the results of these subdivisions of the cases, believing that some general indications thence arising are sufficiently definite to have a distinct value of their own. This has, therefore, been done in Tables II(a) and II(b).

Table II(a) *shows for persons possessing "imperfect" and for persons possessing "good" vaccination at date of attack in each of the age-periods previously dealt with, the percentage of fatality of small-pox, according as the patient presented one, two, or three or more scars. As before, for purposes of comparison, the rate of fatality of small-pox in unvaccinated persons at the several age-periods is given in a separate column.*

TABLE II(*a*).

Age-period, Years.	Unvaccinated.	Age-period, Years.	Vaccinated.					
			One Scar.		Two Scars.		Three or more Scars.	
			b Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.
0– 5	56.5	0– 5	21.9	0.0	13.3	0.0	5.2	2.0
5–10	35.2	5–10	6.7	1.8	7.6	3.3	3.1	0.9
10–15	23.3	10–14	6.9	2.8	5.2	0.7	0.9	0.7
15–20	42.1	14–20	10.4	3.4	6.0	1.7	4.1	2.8

Table II(*b*) *gives the proportional fatality of small-pox attacks at the several ages in the two classes of vaccinated persons, and, in their subdivisions, the fatality of small-pox at each age in unvaccinated patients being represented by* 100.

TABLE II(*b*).

Age-period, Years.	Unvaccinated.	Age-period, Years.	Vaccinated.					
			One Scar.		Two Scars.		Three or more Scars.	
			b Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.
0– 5	100	0– 5	39	0	23	0	9	3
5–10	100	5–10	19	5	21	9	9	2
10–15	100	10–14	30	12	22	3	4	3
15–20	100	14–20	25	8	14	4	9	6

The most conspicuous outcome of these tables is further demonstration of the fact of the immense superiority of "good" (*i.e.*, foveated) over "imperfect" (*i.e.*, unfoveated) vaccination, and a tolerably strong indication that *quantity*,—*i.e.*, number of scars—is an important element in the amount of protection against death by small-pox afforded by a given quality of vaccination.

As to this further illustration of the superiority of foveated vaccination, it is enough to note that in no single instance of the dozen contrasts in the tables between "good" and "imperfect" vaccination is the protection against death afforded by "imperfect" vaccination to be for a moment compared with that resulting from "good" vaccination. This is the more remarkable, since the figures whereon the rates have been in some instances based are small figures, and the

uniformity, therefore, of their testimony exceptionally liable to disturbance.

As regards, however, the indication of quantity of scar as an element of the protection afforded by a given vaccination, the evidence, so far as it goes, is less uniform in its tendency. Concerning "imperfect" vaccination there is indication that multiple scars are associated with a higher degree of protection than are single scars, but as regards "good" vaccination, there is less evidence of this. For the period of life (0-20 years) under investigation a single foveated scar appears indeed as protective as multiple unfoveated scars, but multiple foveated scars do not appear to possess the protective advantage over single foveated scars that multiple unfoveated scars have over single unfoveated scars. This indication, namely, of no great difference of protective value between one and many scars in "good" vaccination, is a somewhat surprising one; and we have hesitated in accepting it as valid until some other data that had been furnished us, and which seemed to promise light on the subject, had been duly examined.

In this connection it deserves notice, that if there be such a thing as transference from class *c* to class *b*, owing to obliteration through time and circumstance of the foveation of scars, it may very well have operated here in giving a fictitious appearance of value to "imperfect" vaccination. In these tables, as in Tables I(*a*) and I(*b*), anomalous improvement at certain ages of the protection afforded by "imperfect" vaccination might in this way be explained; as, for instance, the improvement as regards protection indicated of "one" and "two" scars in class *b* at ages 5-10 and 14-20. Similarly, the comparatively small difference of protective value between classes *c* and *b*, of three or more scars, might be thus accounted for.

The other data referred to possess the advantage of dealing with *severity of attack* instead of fatality of small-pox. Where children—to whom even imperfect vaccination is for a few years subsequent to the operation a very considerable protection against death by small-pox—are concerned, this may be no small gain. For liability to severe attack is likely to be a condition antecedent to increased liability to death by small-pox; and measure, therefore, of liability to severe attack may be thought of as a more delicate test of the protective value of a given sort of vaccination than any comparison of rates of fatality can be. In the present instance the data in question are not so abundant as could be wished, and they do not extend to persons over ten years of age; moreover, in the absence of material for the purpose they cannot be compared with similar data from the unvaccinated class. Nevertheless we give, in Tables III(*a*) and III(*b*), the figures prepared by us from the sources at our disposal,

believing them to be of value as indications of the truth ; and we use for a standard of comparison severity of attack in children only "nominally" vaccinated.

Table III(*a*) *shows for persons possessing "imperfect" and for persons possessing "good" vaccination at dates of attack, in several age-periods, the percentage of severe attacks, according as the patients presented one, two, or three or more vaccine scars (discrete and semi-confluent small-pox being regarded as mild, other forms as severe).*

TABLE III(*a*).

Age-period.	*a* Class. Nominal Vacc.	One Scar.		Two Scars.		Three or more Scars.	
		b Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.
0– 5	34.1	19.5	0	15.5	0	9.3	0*
5-10	38.1	18.1	5.3	12.1	6.6	5.0	2.3

Table III(*b*) *gives the proportional severe cases of small-pox at the several ages in the two classes and in their subdivisions, the severity of small-pox attack at each age in "nominally" vaccinated patients being represented by* 100.

TABLE III(*b*).

Age-period.	*a* Class. Nominal Vacc.	One Scar.		Two Scars.		Three or more Scars.	
		b Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.	*b* Class. Imperf. Vacc.	*c* Class. Good Vacc.
0– 5	100	57	0	45	0	27	0*
5-10	100	47	14	32	17	13	6

The indications of these tables are of a sort to heighten regret that a proper standard from the unvaccinated class is not available, wherewith to compare the figures ; and strongly to suggest that liability to severe attack is, indeed, in childhood a more delicate test than liability to death, of the value of one and another kind of vaccination. Briefly, the indications seem to be these :—

In the first five years of life, when the conflict between liability to death by small-pox and protective influence of recent infantile vaccination is keenest, the quality of *fovea-*

* It should be observed that the fatality of persons from 0-5 years with three or more "good" scars, shown in Tables II(*a*) and (*b*), is due to one death, that of a child who died after an attack of "discrete" small-pox.

tion in scars is obviously all-important in preserving the vaccinated child from severe attack of small-pox. And next to foveation at 0-5 comes quantity, *i.e.*, multiplicity of scars; for at this age three or more "imperfect" scars appear vastly more protective against severe attack than only one, or even two, such scars. As to the second five years of life (5-10), when liability to death by small-pox is waning, and when the protective influence of a more remote primary vaccination is also on the wane, the matter is, of course, more complex. It was at this age that in antecedent tables of this report there was recognised the beginning of a tendency for children to become transferred, by loss of foveation of their scars, from the highest to a lower class, and with the result that "imperfect" scars could at 5-10 appear even more protective against death by small-pox than at 0-5 years. So too, apparently, from Tables III(*a*) and III(*b*), with the protection afforded by "imperfect" scars against *severe attack* of the disease. But however this may be, the sort of vaccination which at 5-10 appears beyond all others protective against severe small-pox is that which presents at the date of attack well foveated scars, and "three *or more*" of them. Thus the proportion of severe attacks at this age in children possessing three or more foveated scars is not more than 46 per cent, that of children possessing a like number of unfoveated scars is only 19 per cent. that of children possessing two unfoveated scars, and is but 12.7 per cent. that of children possessing single unfoveated scars.

In reference to *number* of scars as influencing endurance of protection, the Committee regret again the circumstance that the data furnished them could not be dealt with after the fashion of Mr. Marson's statistics, which allowed comparison of protective value associated with one, two, three, and *four or more* scars. There might, the Committee believe, have been profit in comparing the protective value of three with that of four or more scars, for they are disposed to regard *number* and *quantity of area* of scars as by no means convertible terms.

Re-vaccination and Small-pox.

Questions III and IV.

In addition to certain facts bearing, as just now recorded, in reference to primary vaccination, on severity of small-pox attacks, the Committee have been furnished, in regard of re-vaccinated persons, with some tolerably abundant data respecting their susceptibility to small-pox when exposed day by day to infection by attendance on small-pox patients. As regards persons employed in this fashion, the facts about

1,500 individuals are reported on. They include a few who had had small-pox, and a few also who had been *once* vaccinated only, before entering on their duties; but in the main they were *twice* vaccinated persons, *i.e.*, individuals who having been vaccinated in infancy, were again vaccinated —that is, *re-vaccinated*—just before commencing to attend upon small-pox. Of the total 1,500 thus exposed to infection, only 43 (less than three per cent.) contracted small-pox, and not one of these 43 had been re-vaccinated. In particular illustration of the immunity from small-pox of re-vaccinated persons subjected to close and sustained relation with the disease, the Committee may cite the experience of the Metropolitan Asylums Board. Complete information as to 734 nurses and attendants at the Board's small-pox hospitals are reported to us by Drs. Collie, MacCombie, and Sweeting, and they show that all re-vaccinated nurses and attendants are absolutely protected against attack by small-pox; whereas *once* vaccinated persons, *i.e.*, adult nurses and attendants who by accident or oversight get left with a remote infantile vaccination as their only protection, are apt at some time or other of their hospital service, to become attacked by small-pox. The 734 cases reported on divide into :—

79 persons who had suffered small-pox before taking service at hospital; *not one* of whom again contracted small-pox.

645 persons not only vaccinated in infancy, but re-vaccinated also just before entering on their duties at hospital; *not one* of whom subsequently took small-pox.

And 10 persons vaccinated in infancy, but who *had not been re-vaccinated* before entering on duty at hospital; *every one* of whom contracted small-pox at some period or other of their service.

Further information of the same kind is given by Dr. Gayton concerning 620 attendants, but the fact is not recorded as to the number of these who had previously suffered from small-pox; all but three, however, had been re-vaccinated, and only these three suffered from small-pox after commencing their duties.

As regards severity of small-pox attack in re-vaccinated persons who do contrive somehow or other to contract small-pox, there is not much to be said. Numerically, this class is a very small one, as indeed may be inferred from the hospital experience above recorded; and notwithstanding all diligence of inquiry for small-pox among re-vaccinated persons, only

69 such cases could be heard of. This number is not greatly in excess of the number of persons reported to the Committee as having suffered from a second attack of small-pox,* and it is too insignificant to permit of any but the broadest possible classification of the cases. But it happens that in 61† of these cases information is given which renders them nearly equally divisible into persons presenting at the date of their attack by small-pox cicatricial evidence of their re-vaccination, and persons, nominally re-vaccinated, whose bodies did not, at the date of their small-pox, furnish any such confirmatory evidence of their re-vaccination. Also it happens, as regards both divisions, that the average interval between occasion of re-vaccination and subsequent attack of small-pox was about ten years.

In view, therefore, of the facts recorded in this report as to the incidence of severe small-pox attack upon *once* vaccinated persons, the different behaviour of small-pox in these two classes of re-vaccinated persons is worth noting. Of 36 re-vaccinated people, who at the date of their attack by small-pox retained scars of their re-vaccination, less than 12 per cent. suffered from the disease in its severer forms; whereas of 25 re-vaccinated persons, who at date of their small-pox presented no cicatricial evidence of having undergone the operation, above 20 per cent. suffered severely from the disease. The facts are no doubt too few for secure basis of inference; nevertheless they seem suggestive, that as with primary vaccination so with revaccination, obliteration of scar is correlated with considerable diminution of the protection against small-pox conferred by the operation.

Insusceptibility to Vaccination.

The replies to Question VI cannot be regarded as very satisfactory. In but few cases has information been given as to the total number of persons vaccinated by those gentlemen who stated that they had met with one or two cases of insusceptibility. So far as they go, especially the cases of Drs. Harthill and Vertue, they tend to confirm a belief of

* *Small-pox after a previous attack of small-pox.*—Answers to question V illustrate the fact that people can suffer from a second attack of small-pox, some sixty or more such cases having been communicated to the Committee. A third attack is, indeed, reported in three cases, and in two of them it proved fatal.

† In eight cases no information is given as to whether there was cicatricial evidence of secondary vaccination at time of attack by small-pox.

the Committee, that it is very doubtful whether such a condition as insusceptibility really exists, except, perhaps, under the circumstances mentioned in reply to Question VII. They may add the experience of one of their number (Dr. Cory), who in the vaccination of over 30,000 children not previously vaccinated, did not find a single case of insusceptibility.

Susceptibility to Vaccination of Babies whose Mothers suffered from Small-pox when Pregnant with them.

In reply to Question VII twelve cases are reported, in which the vaccination of babies was attempted, whose mothers, when pregnant with them, suffered from small-pox. In only six of them was note made of the period of pregnancy at which the mother suffered from the disease. In two of the six (communicated by Mr. W. M. Burman), wherein small-pox appeared one and four days respectively before labour, the subsequent vaccination of the babies ran a normal course. Their ages at the time of vaccination are not known. As regard other two of the six (under Mr. J. P. Wilton's observation), the first was born about the fourth week of the mother's small-pox; in the second the exact date of the small-pox cannot be fixed, but Mr. Wilton writes that if his memory serves him correctly, the small-pox occurred somewhat earlier in the pregnancy than in his other case. However this may have been, in both these cases, vaccination of the babies was attempted at least three times during the first eighteen months of life, and failed of success. These four cases tend to indicate, that small-pox attacking a mother during the last few days of her pregnancy, does not affect the fœtus so as to render the baby subsequent to birth insusceptible to vaccination; but that small-pox occurring in the mother at an earlier period of pregnancy does seem to have some such influence. In this connection, two other cases, communicated by Mr. Sweeting, have special interest. In the first the child was born seventeen days later than the date of commencement of the mother's small-pox attack, and vaccination of it immediately after birth proved unsuccessful. In the second the baby was born eight days after commencement of the mother's attack, and in this case the vaccination, which, also, was done immediately after birth, was successful. A third case was reported by Mr. Sweeting, in which the baby was born two days after the mother was attacked. It was admitted into the small-pox hospital when twelve days old, and on admission vaccination was forthwith attempted. Two

days later, however, the child died from inanition, and at its death there was no evidence of the vaccination being about to prove successful. The speedy death of this child after admission to hospital, of course deprives the case of any value in the way of evidence on the point at issue.

APPENDIX.

TABLE I.

Unvaccinated.		Vaccinated.									
			Nominal.			Imperfect.			Good.		
Age-period.	Mort. per cent.	Age-period.	Cases.	Deaths	Mort. per cent.	Cases.	Deaths	Mort. per cent.	Cases.	Deaths	Mort. per cent.
0– 5	56.5	0– 5	82	30	36 6	182	20	11.0	68	1	1.5
5–10	35.2	5–10	165	44	26.6	768	40	5.2	329	5	1.5
10–15	23.3	10–14	164	35	21.3	1056	37	3 5	530	6	1.1
15–20	42.3	14–20	239	63	26.3	2478	157	6.3	1602	42	2.6

TABLE II.

Unvaccinated.				Age-period.	One Scar.						Two Scars.						Three or more Scars.					
					Imperf. Vacc.			Good Vacc.			Imperf. Vacc.			Good Vacc.			Imperf. Vacc.			Good Vacc.		
Age-period.	Cases.	Deaths.	Mort. per cent.		Cases.	Deaths.	Mort. per cent.	Cases.	Deaths.	Mort. per cent.	Cases.	Deaths.	Mort. per cent.	Cases.	Deaths.	Mort. per cent.	Cases.	Deaths.	Mort. per cent.	Cases.	Deaths.	Mort. per cent.
0– 5	677	383	56.5	0– 5	41	9	21.9	6	0	0.0	45	6	13 3	11	0	0.0	96	5	5.2	51	1	2.0
5–10	510	180	35.2	5–10	193	13	6.7	56	1	1.8	197	15	7.6	60	2	3 3	378	12	3.1	213	2	0.9
10–15	317	74	23.3	10–14	244	17	6.9	105	3	2 8	289	15	5.2	148	1	0.7	523	5	0.9	277	2	0.7
15–20	204	86	42.1	14–20	625	65	10.4	346	12	3.4	828	50	6.0	524	9	1.7	1025	42	4.1	732	21	2.8

TABLE III.

Age-period.	Class *a*. Nominal Vacc.			One Scar.						Two Scars.						Three or more Scars.					
				Class *b*. Imperf. Vacc.			Class *c*. Good Vacc.			Class *b*. Imperf. Vacc.			Class *c*. Good Vacc.			Class *b*. Imperf. Vacc.			Class *c*. Good Vacc.		
	Cases.	Severe Cases.	Per cent. Severe Cases.	Cases.	Severe Cases.	Per cent. Severe Cases.	Cases.	Severe Cases.	Per cent Severe Cases.	Cases.	Severe Cases.	Per cent. Severe Cases.	Cases.	Severe Cases.	Per cent. Severe Cases.	Cases.	Severe Cases.	Per cent. Severe Cases	Cases.	Severe Cases.	Per cent. Severe Cases.
0– 5	82	28	34.1	41	8	19.5	6	0	0.0	45	7	15.5	11	0	0.0	96	9	9.3	51	0	0.0
5–10	165	63	38.1	193	35	18.1	56	3	5.3	197	24	12.1	60	4	6.6	378	19	5.0	213	5	2.3

I.—What cases of Small-pox have come under your observation among children under ten years of age who have been

MALES.—TWO CICATRICES.

Under 1 year	...	...	...	...	...	...	...	...	...
1 to 2 years	2	2	...	...	...	...	2	0	
2 to 3 „	12	11	...	1	...	...	12	0	
3 to 4 „	15	11	...	3	...	1	13	2	
4 to 5 „	17	15	...	1	1	...	16	1	
5 to 6 „	24	22	1	1	...	...	24	0	
6 to 7 „	19	16	2	...	1	...	18	1	
7 to 8 „	33	29	2	2	...	...	32	1	
8 to 9 „	47	44	1	2	...	...	46	1	
9 to 10 „	46	37	5	4	...	...	43	3	

FEMALES.—TWO CICATRICES.

Under 1 year	...	...	...	...	...	...	...	...	...
1 to 2 years ...	1	1	...	...	...	...	1	0	
2 to 3 „	6	6	...	...	...	...	6	0	
3 to 4 „	15	13	1	1	...	...	15	0	
4 to 5 „	14	14	...	...	...	...	14	0	
5 to 6 „	30	28	1	1	...	.	29	1	
6 to 7 „	32	32	...	...	...	...	32	0	
7 to 8 „	38	33	2	1	1	1	35	3	
8 to 9 „	43	39	1	3	...	...	41	2	
9 to 10 „	66	60	4	2	...	...	66	0	

STATED TO HAVE BEEN VACCINATED, BUT HAVING NO CICATRIX.

MALES.

Age.	Attacked.	Discreta.	Semi-confluens.	Confluens.	Hæmorrhagia.	Maligna.	Recovered.	Died.
Under 1 year	4	2	1	1	...	...	3	1
1 to 2 years	7	1	2	3	...	1	5	2
2 to 3 „	9	2	3	3	1	...	6	3
3 to 4 „	12	3	3	6	...	...	7	5
4 to 5 „	13	5	4	4	...	...	10	3
5 to 6 „	17	7	4	3	2	1	11	6
6 to 7 „	20	9	5	4	2	...	14	6
7 to 8 „	13	5	3	2	2	1	7	6
8 to 9 „	16	5	3	6	2	...	10	6
9 to 10 „	22	11	4	7	...	...	18	4

FEMALES.

Age.	Attacked.	Discreta.	Semi-confluens.	Confluens.	Hæmorrhagia.	Maligna.	Recovered.	Died.
Under 1 year ...	3	2	1	...	...	...	1	2
1 to 2 years	4	1	1	2	...	...	1	3
2 to 3 „	6	3	1	2	...	...	4	2
3 to 4 „	9	2	4	3	...	...	5	4
4 to 5 „	15	6	7	2	...	...	10	5
5 to 6 „	10	1	4	5	...	...	7	3
6 to 7 „	16	9	2	5	...	...	15	1
7 to 8 „	20	9	3	8	...	...	15	5
8 to 9 „	16	5	3	7	1	...	13	3
9 to 10 „	15	6	4	5	...	...	11	4

II. What number of cases of Small-pox at specified ages have come under your observation among those who have been vaccinated in infancy?

AREA, AND NOT NUMBER OF CICATRIX.

INDIFFERENT VACCINATION.						GOOD VACCINATION.					
MALES.				FEMALES.							
AGE.	Attacked.	Recovered.	Died.	Attacked.	Recovered.	Died.	AGE.	Attacked.	Recovered.	Died.	Attacked.	Recovered.	Died.
10 to 12 years	103	100	3	145	145	0	10 to 12 years	58	57	1	61	60	1
12 to 14 „	118	117	1	157	156	1	12 to 14 „	79	79	0	79	79	0
14 to 16 „	158	158	0	182	177	5	14 to 16 „	95	93	2	104	101	3
16 to 18 „	144	142	2	173	168	5	16 to 18 „	107	105	2	119	115	4
18 to 20 „	132	120	12	236	218	18	18 to 20 „	185	180	5	122	117	5

STATED TO HAVE BEEN VACCINATED, BUT HAVING NO CICATRIX.

MALES.				FEMALES.			
AGE.	Attacked.	Recovered	Died.	AGE.	Attacked.	Recovered	Died.
10 to 12 years	44	32	12	10 to 12 years	38	30	8
12 to 14 „	37	30	7	12 to 14 „	45	37	8
14 to 16 „	40	34	6	14 to 16 „	41	29	12
16 to 18 „	44	33	11	16 to 18 „	35	27	8
18 to 20 „	39	24	15	18 to 20 „	40	29	11

IV.—(a) How many persons have you known to be in personal attendance on cases of small-pox?

GAVIN MILROY, M.D.

GAVIN MILROY, M.D., late an ex-President of this Society, was born and educated at Edinburgh, where he graduated in 1828. As a student there, he was distinguished by his indefatigable industry, his intelligence, and the urbanity of his manners. He was one of the founders and an active member of the Hunterian Society of Edinburgh. He started on his career as an assistant to a practitioner in London; and being desirous of visiting foreign parts, he next took employment in the Government mail-packet service, which gave him opportunities of going to the West Indies, and to the Mediterranean, where the odious usage of quarantine was then exercised to its fullest extent. He retained interest in naval medical affairs, so that, later in life, he published a paper, entitled "The Health of the Navy Considered", which contained many practical suggestions for amelioration. Probably the convictions formed by his life at sea tended to qualify him for the prominent position he held, in his maturity, among those who advocated the inutility of quarantine, and the advantages derivable from sanitary measures in dealing with plague and cholera, and other so-called contagious diseases or pests.

When engaged as a sub-editor on the *Medico-Chirurgical Review*, it fell to him, in 1846, to criticise a "Report on Plague and Quarantine", addressed to the Paris Academy by Dr. Prus, in doing which he raised himself to the first rank amongst epidemiologists. He soon received an appointment of Medical Inspector under the Board of Health; and, in 1850, when cholera raged in Jamaica, he was selected by the Colonial Office to proceed to that island to inspect, and to report on its sanitary conditions, which was done so effectually and so quickly that he was retained as the Government Medical Inspector.

On returning to England in 1854 he was selected to fill a vacancy in the Royal Commission in the Crimea, with Dr. Sutherland and (now) Sir Robert Rawlinson, C.E., which effected so much in co-operating with the medical and engineer staffs of the army, that, although the health of our troops was steadily improving prior to their arrival, the most

perfect of sanitary conditions was established before the setting in of the next winter. His latest foreign mission was that of Medical Commissioner to the West Indies in 1871-2, after which he retired from Government employment with a pension.

To Dr. Milroy we are indebted for his able Report on the Cholera in Jamaica in 1850, and for his part of the Report, conjointly with Dr. Sutherland, "Of the Sanitary Commissioners in the Army in the East"; Parliamentary Papers on Cholera, Plague, Yellow Fever, and Leprosy, all of high national importance.

The *Transactions* of this Society bear ample evidence to the industry and intelligence which characterised him after his retirement from public life. His last years were spent at Richmond, Surrey, where he died on the 11th, and was interred at Kensal Green on the 15th January, 1886; his obsequies being attended by members of this Society, in mark of respect to the memory of a devoted scientist, a valuable public servant, and a sincere man.

The Ordinary Meetings of the Society are held at

11, CHANDOS STREET, CAVENDISH SQUARE,

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THE CHAIR IS TAKEN AT EIGHT O'CLOCK P.M. PRECISELY.

Subscriptions may be paid to the Treasurer. The Annual Subscription of Ordinary Members is One Guinea.

Ordinary Members are entitled to all privileges of membership, and to receive a copy of all the Society's publications issued during the year for which their subscriptions are paid. But Ordinary Members, resident beyond the limits of the Metropolitan Postal District, and having paid one or more annual subscriptions, may, on expressing a wish to that effect, be distinguished as Non-Resident Members.

Non-Resident Members are not liable to further payment. They have the privilege of attending meetings, and are entitled to receive the publications of the Society issued during the year for which their subscription is paid; but they are not entitled to vote at meetings of the Society nor to hold office in it.

The Rules and Regulations of the Society, with an Exposition of its Objects, may be obtained from the Secretaries.

The Transactions for the Sessions 1859-60, 1866-67, *and* 1867-68 *are out of print. With these exceptions, those for the Sessions from* 1860-61 *to the last Session inclusive, may be obtained from the publishers,* Messrs. Shaw and Sons, Fetter Lane, E.C. *Prior to* 1859-60, *the Transactions were published in the* "Sanitary Review." *The issue of a new series of the Transactions was begun in* 1882.

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